STUDY OF MORPHOLOGY OF PLACENTA IN FIFTY SPECIMENS

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CERTIFICATE

This is to certify that the dissertation entitled **"STUDY OF MORPHOLOGY OF PLACENTA IN FIFTY SPECIMENS"** submitted by **Dr.P.MUTHU PRASAD,** postgraduate in Anatomy to the faculty of Anatomy, The Tamilnadu Dr. M.G.R Medical University, Chennai in partial fulfillment of the requirement for the award of M.D. Degree in Anatomy, is a bonafide work carried out by him under my direct supervision and guidance.

Place: Madurai

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DECLARATION

I, **Dr.P.MUTHU PRASAD,** solemnly declare that the dissertation entitled **"STUDY OF MORPHOLOGY OF PLACENTA IN FIFTY SPECIMENS"** has been prepared by me under the guidance and supervision of **Dr.V.RAJARAM D.L.O., M.S.**, Director & Professor I/C, Institute of Anatomy, Madurai Medical college, Madurai in partial fulfillment of the requirement for the award of **M.D. (Anatomy)** Degree Examination of **The Tamilnadu Dr. M.G.R Medical University, Chennai** to be held in April 2012. This work has not formed the basis for the award of any other degree to me from any other university.

Place: **Madurai** **Dr. P. Muthu Prasad**
Date:

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PREFACE

The placenta along with the umbilical cord acts as a transport system of substance between the mother and the fetus. By virtue of its development it is a fetomaternal organ often sustains the developing fetus within the uterine wall of the mother for about 9 months. In the phenomenon of "**placentation**" the chorion which is derived from the developing zygote establishes an intimate relationship of varying degree with the uterine mucosa.

The placental examination provides significant information related to intrauterine and perinatal death, intrauterine growth retardation, malformations, infection and effects of maternal diseases on fetal growth.

Though it is a reproductive tissue, it functions as an important endocrine gland. The discovery of Human Chorionic Gonadotrophin many years ago, led to the development of early pregnancy tests. The placenta is a unique and highly specialized structure that has a temporary but very important series of function during pregnancy. Different experimental approaches such as corrosion casts, serological, histological and ultrasonography methods provide valuable descriptive knowledge of the micro-vascular architecture and morphometric values of the villous tree.

It acts not only as a structure of "anchor" and nutritive bridge but as well as a respiratory and endocrine organ. The placenta acts as an emissary organ between

the offspring and the mother to connect each other; so that the mother's physiological mechanism fields the offspring until its other systems are developed.

CONTENTS

AIM:

To study the morphology of placenta in fifty placental specimens.

MATERIALS AND METHODS:

Study was conducted in the Institute of Anatomy, Madurai Medical College in collaboration with Department of Obstetrics and Gynecology. A total of fifty placental specimens were collected and analyzed for shape, diameter, and thickness, weight of placenta, maternal and fetal cotyledons, and attachment of cord, vascular pattern, feto-placental ratio and placental co-efficient.

RESULTS:

In fifty placentae,60% circular in shape; 38% oval in shape; 2% triangularin shape. The mean Diameter is 17.7 cm. The diameter is increased in Anaemia and decreased in Prematurity. The average thickness is 1.993 cm. The thickness is increased in Diabetes mellitus and decreased in Anaemia. The average number of maternal cotyledons is 17; increased in Diatebes mellitus and decreased in Prematurity. The average number of fetal cotyledons is 59 and increased in Diabetes mellitus. The feto-maternal cotyledon ratio is 3.5:1. It is increased in prematurity and decreased in Diabetes mellitus. The average weight of the placenta is 471 grams. The placental weight is increased in Diabetes mellitus and decreased

in Prematurity. The feto-placental weight ratio is 5.805 and is decreased in Prematurity. The placental co-efficient is 0.18 and is increased in Prematurity.

CONCLUSION:

The morphology of the placenta varies with the clinical conditions associated with the pregnancies. The examination of the placenta yields valuable information regarding the intra-uterine events and fetal outcome. Thus the above study will be useful for the clinicians and anatomists who are doing further research in this field.

INTRODUCTION

Placenta has characteristic of eutherian or placental mammals. The word placenta comes from the Latin for cake, from greek “Plakoenta / plakounta, accusative of plakoeis/ plakous, flat, slab –like in referenceto its round, flat appearance in humans.

The human placenta is a villous haemochorial structure which is of critical importance in maternal – fetal transfer, has a complex synthetic capacity and plays a fundamental role in the immunological acceptance of the fetal allograft.

The placental complex formed by the combined effort between the extra embryonic tissue of the embryo and the endometrial tissue of the mother, represents symbiosis between the two separate beings without rejection. The formation of placenta is a biological event which is important both embryological and immunologically.

The placenta serves the most basic metabolic needs of fetus including respiration, nourishment and excretion by acting as temporary lung, liver and kidney.

It forms an organ for the interchange of material between fetal and maternal blood streams without mixing or physical contact of two blood streams.

The important tasks like hormone synthesis, protein synthesis, immunological role and production of endocrine secretion are carried out by

placenta. Placenta sub serves these purposes until sufficient maturation of the fetus which enables it to survive in the extra uterine environment. The growth of the fetus depends upon the functional capacity, location and integrity of the placental attachment. The placenta is analogous to organs like liver, lung and kidney in function but not homologues with them in structure.

The examination of placenta soon after the delivery is very vital as it gives mirror images of fetal development. It forms the morphological record of anatomical condition, intrauterine events and intrapartum events of gestation. In case of fetal death the examination of placenta is mandatory and examination of placenta yields valuable information for the management of mother and foetus. The handy information regarding placenta is useful for the obstetricianswhich protects them from medico – legal problems in the events of maternal and foetal outcome.

Ultrasonographic examination of placenta is an important part of obstetrical evaluation of pregnancy. With advent of ultrasonography antenatal evolution of placenta have become essential in all pregnant patients as fetal problems and neonatal outcome depends upon status of growth and abnormalities of placenta.

AIM OF STUDY

To study the morphological features of placenta in fifty specimens.

REVIEW OF LITERATURE

The placenta was already recognized and venerated by the early Egyptians, while it was the Greek Physician **Diogenes of Apollonia**(480 B.C) [4] who first described the function of fetal nutrition to the organ.

Aristotle (384 – 322 BC) [4] described that the fetus is fully enclosed within the chorionic membranes.

Realdus Columbus (1559)[4] introduced the word placenta derived from the Latin word meaning a flat cake.

Halban(1905)[37]was the first person to suggest that the placenta is an endocrine organ.

Spanner (1935)[78] described the spiral arteries are opening into the intervillous space through the basal plate itself and not on the septa. Furthermore, he considered that the maternal blood on reaching the intervilllous space, was guided by the septa towards the chorionic plate, when once it was all drained to a "marginal sinus" at the periphery of the placenta.

Ramsey and Harris (1966)[61] demonstrated by low pressure injections of radio – contrast material, that arterial entrances as well as venous exits are scattered randomly over the entire base of the placenta.

Boyd and Hamilton (1970)[12] stated that the average placenta at term was 185mm in diameter, 23mm in thickness, with a volume of 497ml and weight of 508gm.

Ramsey and Donner (1980)[90] described the development of the utero placental vessels proceeds in two waves or stages.

I wave - occurs before 12 weeks post fertilization and consists of invasion and modification of spiral arteries upto the border between deciduas and myometrium.

II wave - Between 12 to 16 weeks and involves some invasion of the intra myometrial segments of spiral arteries.

Pijnenborg et al(1981)[90] stated that the proliferative activity of the cytotrophoblast and its rapid migration into the depth of the endometerium appears to be responsible for the further expansion of the implantation area.

Denker and Aplin (1990)[90] stated that the usual implantation site is the upper part of the posterior wall of the uterine body near to the mid- saggital plane.

Pijenburg (1994)[90] stated that the Extravilloustrophoblast migrate into decidua and myometrium, also penetrates maternal vasculature, thus comes into contact withmaternal cells. The villous trophoblast gives rise to the chorionic villi which primarily transports oxygen and nutrientsbetween the fetus and the mother.

Lervas and colleagues (1999)[90] stated that the Hofbauer cells, produces a variety of cytokines which is of capable of paracrine regulation of trophoblastic in function.

Hanna and associates (2006)[90]have elucidated that the ability of Decidual Natural killer cells (dNK) to attract and promote invasion of trophoblast into decidua to promote vascular growth.

Manaster and Co - workers (2008)[90] found that the Decidual Natural killer cells (dNK) accumulate in the decidua during the first half of pregnancy and are found in direct contact with trophoblast. This cells lack the cytotoxic function.

Shape Diameter and Thickness of the Placenta

Henry Gray (1858)[39] quoted that the expelled placenta is a flattened discoidal mass with an approximately circular or oval in outline and the average diameter is about 185 mm with range of 150-200 mm and the average thickness is 23mm with range of 10-40mm.

Leslie B Arey (1924)[54] stated that the expelled placenta is typically a thick circular disc. In addition to circular shape which is quite common ranging from an oval contour to other variant forms like spindle, pear, heart, crescent, ring- shaped which are more rarely encountered. The placenta may be notched, lobed or even divided completely. Accessory placentas of smaller size than the main placenta

are usual. Fusedplacenta results when ordinary twins become too closely implanted. Placenta measures 17.5 cm in diameter and 2.5 cm in thickness.

Williams (1930)[89] in his book of obstetrics described that there are anumber of abnormal placental shape variations.

i. Multiple placentae with a single fetus:

Placenta may be separated into lobes when the division is incomplete and the fetal vessels extend from one lobe to the other lobe before uniting to form the umbilical cord, this condition is termed as placenta biparita or bilobata.

ii. Succenturiata placenta:

This variation results when one or more small accessory lobes are developed in membranes at a distance from the periphery of the main placenta to which they usually have vascular connections of fetal origin.

iii. Ring shaped placenta:

The placenta is annular in shape which is very rare.

iv. Membranaceous Placenta:

All of the fetal membranes are covered by functioning villi and the placenta develops as a thin membranous structure occupying the entire periphery of the chorion.

v. Fenestrated Placenta:

The central portion of the discoidal placenta is missing in this variant.

vi. Extrachoridal Placenta - Circumvallate placenta:

The Chorionic plate on the fetal side of the placenta is smaller than the basal plate and the fetal surface of such a placenta presents a central depression surrounded by a thickened grayish white ring it is called a circumvallate placenta. When the ring coincides with the placental margin the condition is sometimes described as circum -marginate placenta.

Bradley M.Patten (1946)[13] described that placenta which is round may exhibit a bi -lobed shape.

T.W.Sadler (1963)[66] noted that at full term the placenta has a discoid shape and is approximately 3 cm thickness.

K.Benirschke et al (1967)[9] mentioned in their book 'The Pathology of Human Placenta' that the average thickness of the placenta in the centre is 2.0cm.

Torpin.R (1969)[84] mentioned that in more than 90% of cases of full term delivered placenta are disc- like flat, round to oval organ. They had abnormal shapes such as placenta bilobata and placenta succenturiata.

J.D.Boyd&W.J.Hamilton (1970)[12]described in their study that the full term placenta is flat with a round or oval in outline. The placenta may

be bidiscoidal,trilobed ,succenturiate, extra chorial or membranaceous. Theaverage diameter of the placenta is 185mm and the thickness is 23mm.

Keith.L.Moore&T.V.N.Presaud (1973)[47] described that the shape of the placenta is circular. The placenta measures 15-20cm in diameter and thickness is 2-3 cm.

Richard.S.Snell (1973)[63] described that placenta is flattened and circular in shape. Its diameter is about 20 cm and its thickness is 2.5 cm.

Boyd & Wynn(1974)[50] stated that the diameter increases from average 600mm at 3rd month to an average of 180mm at full term.

Sarojamma(1986)[69] studied in 100 placentae that the thickness of the placenta ranged from 1.5 cm to 2.0 cm.

J.P.E.Judson (1986)[45] reported in a study of 20 placentae that the average diameter of the placenta is 169.7mm.

Benirchke & Kaufmann (1990)[10] stated that the placenta increases its surface area and thickness with accompanying increase in size, length and complexity of branching of the villous stems throughout the pregnancy.

Cynthia.G.Kaplan (1996)[46]stated that the thickness of the placenta is 2 cm to 2.5 cm.

Presade(1996)[90] stated that the shape of the placenta is determined by the shape of the persistent area of chorionic villi and usually this is thecircular area giving the placenta a discoid shape.

Gray's Anatomy (2000)[32]mentioned that in case of membranacea the villous stem and their branches persist over the whole chorion.

BenirschkeandKaufmann (2000)[90] in their work of over 13500 placentae, found 5.3% incidence of extra chorial placenta.

GunaPriya. R. (2001)[35]studied in 100 placentas and observed 93% circular and 7% oval shapes of placenta. The average diameter of the placenta was 17.4 cm, range 12 – 22 cm and thickness was 2.1 cm, range 1.5 – 2.7 cm.

	Year	Placental Thickness(cm)	Placental Diameter (cm)
Copenhower WM	1923	2.5	17.5
Williams et al	1969	3	15-20
Boyd Hamilton	1970	2.3	18.5
Bhatnagar et al	1983	3	16-20
S.W.Sahana	1988	1-5-3	15-18
Peter L Williams	1995	1-4	15-20

Placenta duplex:

Sandifort(1778)[68]mentioned about placenta duplici.

Horing(1838)[42] presented a case report in which placenta was divided into two fairly equal parts which were connected only by chorion and amnion.

Hohl(1851)[41] argued that the ovum attached to both anterior and posterior walls of the uterus in that these surfaces in the non – pregnant state lie close together.

Ahlfeld (1887)[2] said the incidence was about 1 in 600.

Ribemont – Dessaignes(1887)[62] said the incidence was about 1 in 733.

Itzkin (1929)[44] demonstrated one placental disc on the posterior uterine wall and one on the anterior wall.

Kehr (1904)[48]reported upon 60000 consecutive placentas over a period of eighteen year and stated that there were seven placentas which are duplex.

Richard Torpin (1969)[82] examined 10,000 fresh human placentas; and found 5 distinctly double discoid placentas and reported the incidence of 1:2000.

Micro Placenta:-

Schwarz (1938)[71] was the first to report upon microplacenta, his case was primipara who delivered a dead born fetus with weight of the placenta was 431gm: 11x15cm; 1.5cm thickness

Geisendorf(1949)[28] reported 3 cases

I case Measured 10x13cm of weight of 170gm

II case Placenta was very small and weighted 200gm

III case Placenta was 320gm

Rumbolz and Mcgoogan (1953)[65] stated that the incidence of micro placenta was 0.24%.

Placenta Biloba (Bipartita)

Hohl (1851)[41] stated that probably or greater part of the placenta is always seated upon the anterior or the posterior wall of uteus.

Ribemont – Dessaignes (1887)[62]presented 25 cases of placenta out of which seven were placenta biloba.

Monges(1907)[57] and Delecour and Diesbercq (1920)[57] stated that the two lobes of the placenta bilobawere relatively equal in size.

Gudewill(1927)[34] in his case reports stated that two lobes in placenta biloba were of equal size and connected by a bridge of placental tissue 4cm wide.

Itzkin(1929)[44] reported two case histories and stated that the two lobes were heart shaped with the lobes almost equal in size and joined by a bridge of placental tissue 12cm wide.

Torpin and Hart (1941)[82] reported that the incidence of placenta biloba was 8.7%.

Augero.O (1957)[83]reported 3.26% of incidence of placenta bilobulata or biparita in his study.

Fujikura et al (1970)[83]found palcentabiloba of about 4.2% in 8505 specimens collected in the collaborative perinatal study.

Fox.H (1978)[27] pointed out that placenta biparita or bilobata's incidence varies widely and it is cited at about 1 of 350 (0.2%) deliveries.

Placenta Succenturiata:-

De Lee (1913)[18] stated that if the ovum attaches itself to the centre of either the anterior or posterior wall of the uterus, the placenta probably will be round or oval.

Torpin(1969)[83] found in his study of 500 consecutive fresh placentas, there were six instances of placenta succenturiata.

Williams (1930)[89] stated that this variation results when one or more small accessory lobes are developed in the membranes at a distance from the periphery of the main placenta to which they usually have vascular connections of fetal origin.

Roth L.G. (1957)[83] mentioned that succenturiate lobes may occur singly or in multiples.

Attachment of the cord:

Horing(1838)[42] stated that there was as plit in the umbilical cord into two branches, each provided with two arteries and one vein and reaching the placenta in placenta bilobata.

Hohul (1851)[41] presented a case of placenta duplex in which the umbilical cord was inserted on the membranes separating the two discs.

Grieco (1936)[33] said that in a study of 23,409 placentas of singleton pregnancies, he observed 0.41% of velamentous type of cord insertion.

Simon Brody and David.A Frankel (1953)[76] observed that out of 512 deliveries, they observed 6.2% of marginal insertion of the cords.

Diterlizzi&Rossi C.R. (1955)[22] concluded in a study of 15,416 placentae of singleton pregnancies, 1.0% of velamentous type of cord insertion.

Scott J.S. (1960)[72]reported in a study of 3,161 placentae of singleton pregnancies 2% of marginal type and 1.5% velamentous type of cord insertion.

Corkill.T.F (1961)[15]In a study of 12695 placentae obtained from singleton pregnancies he reported 0.024% of velamentous type of cord insertion.

Thomas J (1963)[80]stated that of 18316 placentae he studied he observed 5.2% marginal type 1.3% velamentoustype of cord insertion.

Torpin R & Barfield W.E (1968)[84] found that in one third of bilobed placenta the cord insertion is on the larger lobe andin two third it has velamentous insertion.

Shanklin (1970)[73] noticed velamentous or marginal type of insertion of cord in infants weighing less than 2500 gram.

Uyanwah et al (1977)[85] mentioned that in a study of 1000 placenta obtained from singleton pregnancies, they found 5.6% marginal type of cord insertion & 1.6% velamentous type of cord insertion.

Robinson et al (1983)[64]: stated that in a study of 44,677 placentae, they observed 8.5% marginal type and 1.5% velamentous type of cord insertion.

Benirischke.K (1996)[8] reported that in velamentous insertion the cord was not connected to placental plate, but its vessels travelled between the membrane before attaching eccentrically to the placenta.It happened in 1.1% singleton pregnancies and 8.7% of twins. Associated anomalies were found in 5.9 -8.5% of cases.

Fox (1997)[27] stated that marginal insertion was less common than as eccentrically placed cord. The vessels of the velamentously inserted cord were also susceptible to damage during labour and there were reports of bleeding from such vessel during the antepartum period.

Benirschke and Kufman (2000)[90] observed that in 7% of velamentously inserted cord.

AUTHOR	CENTRAL	ECCENTRIC	MARGINAL	VELAMENTOUS
Hystl.J(1870)	16%	54%	19%	-
Chiari(1985)	3.3%	91.2%	5%	0.5%
Lefevre.G(1896)	-	-	-	0.84%
Noldeke.H(1934)	-	-	-	1.1%
Earn.A.A(1951)	56%	28%	15%	1.1%
Simon Brody et al (1953)	-	-	6.2%	-
Shanklin.D.R (1958)	11%	89%	1.9%	0.78%
Krone.H.A (1961)	25%	64%	10%	1%
Monie.I.W(1965)	-	70%	14.7%	15.3%
EastmanN.J.& Hellmann L.M(1966)	18%	75%	7%	1.25%
RichardTorpin (1969)	29%	63%	32%	-

Placental weight:

Henry Gray (1858)[39]stated that the average weight of the expelled placenta is 470gms, range 200 – 800 gms.

Adaire and Thelander(1925)[1] observed that the weight of human placenta have been found to be linearly related to the placental surface area and therefore can be used as an accurate estimation of the surface area available for diffusional exchange.

Ghosh&Chandraseker.C (1948)[31] reported that the weight of the placenta in mature male and female infants on an average was 486.3 gms and 479gms in contrast to premature infants where the figures were 391.1 gms& 379.1 gms respectively.

Dockery J.L (1960)[23] reported a case of giant placenta weighting 1.984 gms with Hemoglobin value of 4.1gms per 100ml due to severe iron deficiency.

Wiggles worth (1962)[87] found that the placental weight ranged from 360 – 570 gms.

Wong, T.C. &Lartour J.A.P. (1966)[91] reported a lower placental weight of 399 gms for growth retarded infants as compared to 463gms for normal infants.

K.Benirschke et al (1967)[9] reported that the average weight of the placenta was found to be of 470gms.

Thomson et al(1969)[81] Observed that the weight of the placenta increases by nearly 50% if the membranes, umbilical cord and adherent blood clots are not removed and he felt that wide variation in placental weight because of the above said factors.

Saigel .S &Srivastava J.R. (1970)[67] reported that the weight of the placenta was 531.5gms at 38 weeks of 475.9gms at 42 weeks and above.

J.D. Boyd and W.J. Hamilton (1970)[12] studied over 1000 placentae delivered at term and quoted that the average weight of the placenta was 508gms.

Gupta et al (1972)[36]studied in 469 placentae the mean weight of the placenta was found to be higher for males as compared to females. The mean placental weight of infants below 37 weeks of gestation was 449.9gms and 405.3gms for males and females respectively, while it was 521.9gms and 510.4gms respectively in babies of 37 weeks gestation and above.

`Keith L.Moore and T.V.W. Persaud (1973)[47] that placenta weighted 500 to 600 gms which is about one sixth of the weight of the average conceptus.

Richard S.Snell (1973)[63] stated that placenta weights about 500gms.

Shameer Singh et al (1979)[74]reported in a study of 3500 placentae that mean weight of the placenta was found to be 475 gms.

J.P.E. Judson (1986)[45]found that in a study of the placentae, the average weight of the placenta was noted to be of 479.17gms.

Godfrey K.M. et al (1991)[29] observed large placental weight, which wasassociated with a low maternal hemoglobin.

Virupaxi R.D. et al (2002)[86] found that placental weight, placental volume and decidualsurface area were significantly smaller in low birth weight babies and as compared to full term normal babies.

Dr.Ahmed Alexander Bas Chat (2004)[24] : stated that placental fetal growth and development remain closely related throughout gestationand follow distinct patterns of initial fetal weight increases in correlated with placental glucose and amino acid transport.

Name of the Author	Year	Placental Weight(ingrams)
Benirchke	1961	425 – 550
Williams et al	1969	500
Boyd J.D.	1970	450 – 600
Hamilton & Boyd	1970	508
Fox H	1978	323.55
AshaV.Kher et al	1981	425
Bhatnagar et al	1983	500
Kaplan CG	1996	350 – 750

Majumdar et al (2005)[56] observed that the mean placental weight in control group Were 485.85 gms and in 13 hypertensive patient group to be 399.10 gms. The Mean feto placental weight ratio was found to be 5.89 in control group and 6.23 in Hyper tensivegroup.

Feto – Placental Weight Ratio:-

Little (1960)[90] studied the placentae of 956 mature infants and concluded that the placental co- efficient of less than 0.10 and greater than 0.18 should be considered to indicate a relatively small or large placenta and that less than 0.08 and more than 0.2 should be considered definitely abnormal.

Singla P.N. et al (1978)[77] quoted that in a study of 69 anaemic mothers (Hemoglobin <11grams) and 16 mothers without anaemia (Hemoglobin <11grams) the birth weight and placental weight were significantly reduced in the severely anaemic mothers and it had direct relationships with the maternal hemoglobin levels.

Kher&Zawar (1981)[48] mentioned that a significant reduction in feto – plancetal weight ratio was observed in toxemia of pregnancy.

Bonds et al (1984)[11] observed that incidence of perinatal problems was increased in those infants whose feto - placental weight ratio was greater than 11.

Lurie .S et al (1999)[55] studied in 431 deliveries and reported the mean new born weight was 3,382 gms and the mean placental weight was 613gms. Mean Feto placental weight ratio was 5.6 and this ratio did not differ in male (5.7) and females (5.6) infants.

Damania et al (1989)[17] studied sixty placentae of hypertension disorders of pregnancy and reported that the birth weight, placental weight and feto placental ratio were less in hypertensive cases than in the normotensive controls.

A.K.Dutta (2000)[5] stated that ratio of placenta - fetal weight is 6:1 in I month; 1:1 infourth month and 1:7 at birth.

Kucuk.M, Doymaz F (2008)[52] : stated that the placental weight and placental weight to birth weight ratio are increased in diet and exercise treated gestational diabetes mellitus (GDM) subjects.(They observed that birth weight in GDM to be 3288.3gms and 3207.06gms in control group. Placental weight in GDM was found to be 694.8gms & 610.2gms in control group. Placental co-efficient (PW/BW) was noted to be 0.21 in GDM and 0.18 in control group.

Placental Cotyledons:-

Henry Gray (1958)[39]quoted that the maternal surface of the placenta is finely granular and mapped into some 15 - 30 lobes.

According to **Arey**(1956)[83], Maternal cotyledons number as 15-20 and estimated that the number of fetal cotyledons of range up to 200.

Crawford (1959)[83] stated that the total number of placental lobes remains the same throughout gestation and individual lobes continue to grow although less actively in final weeks.

T.W. Sadler (1963)[66] described that when the placenta is viewed from the maternal side, 15-20. Slightly bulging areas, the cotyledons, covered by a thin layer of deciduasbasalis are clearly recognizable.

Hamilton, Boyd, Mossmans (1966)[38]stated that the number of maternal cotyledons variesbetween 10-38.

Williams et al (1969)[88] stated that the maternal cotyledons number is 15-20.

K.Benirschke etal (1967)[9] said that an incomplete system of grooves subdivides the basal surface of the placenta into 10 to 40 slightly elevated areas called maternal cotyledons (lobes or lobules).

Allan C Barnes (1968)[3] mentioned that the cotyledons are indistinct lobulations about 30 in number visible on the maternal surface of the placenta.

Sarojamma(1986)[69] found in astudy of 100 placentae, that the average number of cotyledons to be 18 with a range of 3-24.

According to**A.K.Dutta** (2000)[5],the maternal cotyledons number is 15-30 and suggested that each cotyledons contains 2-4 major stem villi called fetal cotyledons.

According to **Gray** (2002 – 2005)[32] edited by Peter L. Williams, early in pregnancy 800 – 1000 fetal cotyledons are seen but as pregnancy advances with the formationof chorionlaevae and possibly some fusion between the adjacent

stems the number of cotyledons progressively reduced to about 60 at term, it is also stated that the number of cotyledons vary between 15-30.

Majumdar et al (2005)[56]studied 100 placentae and reported mean number of cotyledons in normal group to be 19 and 18 in hypertensive.

Sultana.S et al (2007)[79] in a study of total 45 placentae and found that compared to controls there was less placentae diameter and cotyledon number in eclampsia.

Vascular pattern of placenta:

Shordania.J (1929)[75] sub divided the arteries in human placenta into two groups, Disperse type, in which the two arteries divide dichotomously several times into smaller vessels rapidly diminishing in diameter. In magistral type, the two arteries had longer undivided branches.

P. Bacsich&C.F.V.Smount (1937)[6] studied the fetal vessels of 50 human placentae with corrosion technique. According to the pattern of placenta can be divided into two groups (i) Disperse type and (ii) Magistral type.

Kishore.N&Sarkar.S.C (1967)[50] viewed that the disperse type of vessel distribution is more common (61.8%).

Andrade.A (1968)[4] mentioned that disperse type of vascular pattern to be more frequently found in placentae with centrally inserted cords.

MATERIALS AND METHODS

The present study was conducted in the Institute of Anatomy, Madurai Medical College, Madurai in collaboration with the Department of Obstetrics and Gynecology of Government Rajaji Hospital, Madurai.

A total of fifty freshly delivered placentae with umbilical cord were collected from the Department of Obstetrics and Gynecology, Government Rajaji Hospital, Madurai. The specimens were collected soon after their expulsion from normal deliveries and caesarean section.

Placentae and umbilical cord were collected from the following:

1. Normal uncomplicated primigravida and multi-gravida cases contributing to 44 specimens of which male and female conceptus placentae were 26 and 18 respectively.

2. Pathological conditions and factors complicating pregnancies contributing to 6 specimens of which 1 are male conceptus and 5 are female conceptus.

i) Anaemia – 2 specimens (1 male, 1 female)

ii) Gestational Diabetes Mellitus – 1 specimen (1 female)

iii) Prematurity – 3 specimens (3 female)

The collected specimens were analyzed using the following instruments:

- Scissors.
- Toothed and non-toothed forceps.

- Scalpel.
- Inch tape.
- Digital vernier caliper.
- Weighing scale.
- Cotton.

METHODS:

The conceptus whose placentae were obtained was examined for the following facts:

- Sex of the baby
- Weight of the baby
- Any visible anomaly of the baby
- Maturity of the baby

The collected specimens were washed in tap water; membranes were examined and then trimmed. The specimens were then transported to the Institute of Anatomy, Madurai Medical College, Madurai, in 10% formalin filled plastic container.

The following parameters were studied in the specimens and are tokened from 1 to 50 numbers. The observations were photographed and variations noted.

TOTAL NUMBER OF SPECIMENS – 50

- **Shape, Diameter and Thickness:**

  i. Shape – was noted and recorded.

  ii. Diameter – of the placenta was measured with an inch tape.

  iii. Thickness – was noted by Digital Vernier Caliper

Initially the vernier caliper was checked for zero error with jaws closed. The jaws of the caliper were placed on either side of the peripheral margin of the placenta with firm pressure on the placental surface. When both the locking screws

of the caliper were tightened the caliper was removed from the placenta and the readings were recorded after the measurement in the digital screen of the caliper was corrected to the nearest tenth of the centimeter.

- **Maternal Surface**: The number of cotyledons were counted and recorded.
- **Placental Weight**: Weight of the placenta was recorded using a weighing scale. Babies (conceptus) whose placenta was also examined for the following facts:-

- Sex of the baby was recorded.
- Weight of the baby recorded by weighing scale.
- Maturity of the baby was noted.

Preterm conceptus was babies born before 37 weeks of gestation. Term conceptus was babies born from 38-40 weeks of gestation.

DIGITAL VERNIER CALIPER

- **Fetal Surface:** Type of insertion of the umbilical cord was noted. By dissection method the number of fetal cotyledons were dissected out and counted.
- **Feto – Placental Ratio:** It is calculated by the ratio of fetal weight by placental weight.
- **Placental Coefficient**: It is calculated by the ratio of placental weight by fetal weight.

ANATOMY AND DEVELOPMENT OF PLACENTA

At full term the human placenta has the shape of a flattened cake (Plakuous= placenta = cake). The human placenta is described as discoid, deciduate, haemochorial,chorioallantoic, labyrinthine and villous organ.

To establish intrauterine pregnancy,trophoblast must anchor and invade decidualised, endometrium and uterine vasculature must change to allow progressive increase in blood flow. Just before implantation zonapellucida disappear and the blastocyst embraces the endometrial surface and the blastocyst is composed of 107 to 216 cells.

Most commonly implantation takes place into the endometrium of the upper part and more often on the posterior wall of the surface endometrium. The trophoblast invades into the endometrium and thus leading to the implantation. The role of the trophoblast in nutrition of the conceptus is reflected in its name. Itfunctions as endocrine organ in human during pregnancy.It is essential to maternal physiological adaptation and maintenance of pregnancy. When the trophoblast become lined with mesoderm the two layers together constitutes an extra embryonic membranes known as the “chorion”. The period from 9^{th} to 25^{th} day is one of the intense growth and differentiation from the chorion. At the 13^{th} day, the trophoblast is still in trabeculated mass of syncytium with lacunae. Some of which contains material blood and inner layer of cytotrophoblast begin to appear

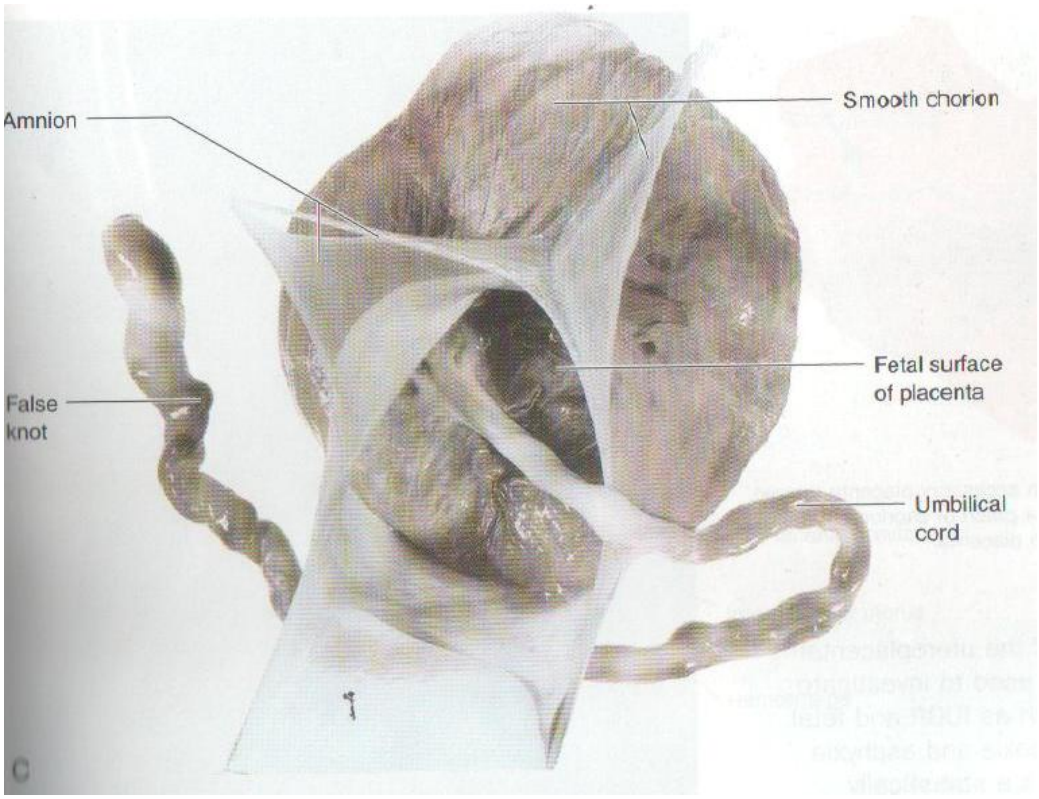
in the trabeculae. The first result of the growth process is that the trabeculae instead of being arranged quite irregularly tend more and more to become oriented radially round the chorion and therefore to take on a villous appearance. Soon the syncytial trabeculae come to possess a cellular core by active multiplications of cytotrophoblasticcells on their deep chorionic surface and it is at this stage the highly modified trabeculae are called as primary villi. The maternal part of placenta is derived from the decidua basalis. The placenta consists of chorionic plate on the fetal side, basal plate on maternal side, the stem villi extending between the plates and the inter-villous space between stem villi being filled with maternal blood. The chorionic plate is composed of structures from fetal to the maternal side, primary mesoderm containing branches of umbilical vessels, cytotrophoblast andsyncytiotrophoblast. The basal plate consists of, from material to the fetal side stratum spongiosumof deceiduabasalis, outer layer of syncytiotrophoblast which undergoes fibrinoiddegeneration (**Nitabuch's membrane**) outer shell of cytotrophoblast inner layer of syncytiotrophoblast and outer zone of this layer also undergoes fibrinoid degeneration is known as **Rohr's fibrinoidstrai**. As the basal plate is being perforated by the spiral branches of uterine arteries and veins eventually the inter-villous space is filled with maternal blood. The stem villi connect the chorionic and the basal plates which forms primary, secondary and tertiary villi with the progress of development. The

primary villous consists of central core of cytotrophoblast and is covered by syncytiotrophoblast secondary villus contains central core of primary mesoderm and is covered successively with cyto and syncytiotrophoblast. From each tertiary stem villus numerous branching villi project into the inter-villous space. By about 17^{th} day the fetal blood vessels become functional and the placental circulation is thus established.

In the early pregnancy they are distributed all over the periphery of the chorionic membrane and later the villi in contact with deciduas basalis proliferate to form the leafy chorion, called chorionic frondosum. The villus in contact with decidua capsularis ceases to grow and degenerate to form the chorionic bevel. The chorionic laevae is translucent and of 1mm thick. In human, chorionic laevae and amnion form avascular aminochorionwhich forms an important site of molecular transfer and metabolic activity. That pattern of villus arising from the chorionic plate is main stem villus are **truncuschorii**, the distal end of each truncus has variable number of subdivisions called the **rami chorii**, which in turn branch to form minor villus stem or **ramulichorii**. As the placenta continues to mature during the 4^{th} and 5^{th} month the inter-villous space is gradually subdivided by the formation of the septa which projects from the basal plate into the inter-villous space but do not reach upto the chorionic plate.

The placenta is thus incompletely divided into 10-38 lobes, the placenta lobes contain villi of the chorionic frondosum extending from the chorionic plate to the decidua and serve as a anchoring villi. Each of main stem villi and their ramifications constitute a placental cotyledon (lobes). Each cotyledon is supplied with a branch of chorionic artery, a vein, constituting 1:1:1 ratio artery to vein to cotyledon. In each part of pregnancy800-1000 stem villi radiate from entire chorionic wall later with regression of chorionic laevae only 60 stem villi persist in human placenta. Since number of maternal cotyledons is 15-30, it is suggested that each cotyledon consists of 2-4 major stem villi. A major stem villi and vessels derived from it constitute the fetal cotyledon.

HUMAN PLACENTA



Full term placenta:

At full term human placenta has the shape of a flattened cake (plakuos – placenta –cake)

It has an average diameter of 15-20cms, thickness of 3cms and weight about 500gms.

The structure of a term placenta has the following

Basal plate:

This forms the floor of the placenta. From outside inwards it consists of

(i) part of the compact and spongy layer of deciduabasalis

(ii) layer of Nitabuch

(iii) Cytotrophoblastic shell.

(iv) Syncytiotrophoblast.

The basal plate is perforated by the spiral branches of uterine vessels for the entry of maternal blood into inter- villous space. Placental septa are found projecting from the basal plate into inter -villous space. These septa divide theinter-villous space incompletely because they fail to reach the chorionic plate. The areas between the septa are called cotyledons.

Chorionic plate:

This forms the roof of the placenta from outside inwards it consists of

(i) Primitive mesenchymal tissue with branches of umbilical vessels,

(ii) Cytotrophoblast and (iii) syncytiotrophoblast. The stem villi actually arise from this plate.

Intervillous space:

Numerous branch villi arising from the stem villi project into this space and constitute the main content of the choriodecidual inter-villous space. The placenta is thus limited between the chorionic plate (lined internally by the amniotic membrane) on the inner or fetal side and by the decidua and basal plate on the outer or maternal side, with the choriodecidual space lying in between.

Aging of the placenta:

Like all other organs, placenta also undergoes degenerative changes as a mark of senescence which affects both the fetal and maternal components of the placenta as follows:

Changes in the villi:

From 24^{th} week, there is partial disappearance of cytotrophoblastic cells but syncytiotrophoblastic layer remains unchanged.

At 36^{th} week, cytotrophoblastic cell layer disappears almost completely. The syncytium becomes attenuated and aggregations of nuclei

(syncytial clumps) appear within it. There is deposition of fibrin on the surface of villi.

Changes in the intervillous space:

The syncytium undergoes fibrinoid degeneration at places with the formation of mass entangling many villi thus forming the so –called white infarcts of varing sizeof calcification or cyst formation may also occur.

Changes in the decidua:

The Layer of Nitabuch a fibrinous layer is formed at the junction of the cytotrophoblastic cell with the decidua. A locally active defense mechanism (immunological) most probably operates at this level preventing excessive penetration of the decidua by the trophoblast.

Classification of placenta:

According to the attachment of umbilical cord:

1. Battledore placenta:

   The umbilical cord is attached close to the margin of placenta.

2. Velamentous placenta:

   When the cord fails to reach the placenta and it is attached to the fetal membrane close to the periphery of the organ. It occurs more frequently with twins and it is almost the rule with triplets.

According to the site of implantation

Placenta praevia:

This condition is the blastocyst implanted in the lower part of the uterine cavity overlapping the internal os of cervix.

According to the degree of Adhesion or Penetration.

1. Placenta accreta : Placenta adhered to deciduabasalis.
2. Placenta increta : It penetrates into myometrium
3. Placenta Percreta : It penetrates the entire wall of uterus.

According to the shape:

1. Lobed placenta:

   It exhibits two or more lobes.

2. Placenta Membranacea:

   It is diffuse and thin and the chorionic villi project from the entire blastocyst cavity.

3. Circumvallate Placenta:

   The peripheral margin of the placenta is surrounded by a sulcus and is overlapped by a circular fold of deciduas.

According to the distribution of umbilical Artery:

1. Disperse type:

   The umbilical arteries divide in a dichotomous manner and undergo successive reduction in caliber.

2. Magistral type:

   The arteries maintain almost a uniform caliber up to the periphery of the placenta and gives off small branches.

According to the tissue forming the placental barrier

Placenta can be classified phylogentically as follows:

1. Epithelio – Chorial (eg - Pig)

   Endometrium intact fetal and maternal tissues come in direct contact only. Placenta is non – deciduate.

2. Syndermo – Chorial (eg – Bovine)

   Endometrial epithelium disappears.Chorion is separated from the maternal blood by endometrial stroma and endothelium of maternal capillaries.

3. Endothelio – chorial (eg –Dog)

   Fetal chorion erodes the endometrial stroma upto the endothelium of the maternal vessels.

4. Haemo – Chorial (eg –man)

Endothelium of maternal vessels disappears by the corrosive action of thechorion maternal blood directly comes in contact with the chorion and its villi.

The human hemochorial placenta can be subdivided into hemodichorial or hemomonochorial(Ender's 1965)[90]. The Hemodichorial type is more prominent during the first trimester of gestation and the hemomonochorial type is present in the later pregnancies.

5. Haemo –endothelial (eg –Rabit)

The trophoblastic cells of the chorion degenerates to such an extent that only endometrium of the fetal vessels intervenes between maternal and fetal blood.

According to intrauterine site of attachment or implantation:

1. Single Discoid Placenta:

Result from interstitial decidual ovular implantation of either anterior or posterior uterine decidual walls, both of which are relatively flat.

2. Placenta Biloba:

Result from decidual interstitial decidual ovular implantation into lateral or apical crease joining the anterior and posterior decidual sheets.

3. Placenta Previa:

   Interstitial decidual Ovular implantation in the lower uterine wall.

4. Placenta Annularis (zonaria, Gurtel placenta)

   - Probably central decidual ovular attachment or implantation into uterine canal so small as to touch all the sides of the tiny egg simultaneously.
   - In the normal uterus this condition can obtain only in the region directly above the cervical canal.
   - When higher in fundus the situation must involve uterus unicornis or one cavity of uterus bicornis.

5. Interstitial Ectopic Pregnancy:

   With implantation close enough to the uterine cavity end of the fallopian tube to allow the enlarging fetal sac to herniate into the uterine cavity thus possibly resulting in a type of placenta circumvallata (Heinrich Bayer 1910)[90].

According to diverse degrees of ovular attachment or ovular implantation into decidua:

1. Placenta Duplex (1:1000) :

   Two discoidal placentas which attaches to both anterior and posterior uterine wall (Monkey type). Placenta succenturiata is a variation of this type.

2. Normal placenta (60%):

   Primarily diffuse but become secondarily discoid to one anterior or posterior uterine wall.

3. Placenta Marginata (30%):

   Primarily diffuse but secondarily discoid to either anterior or posterior uterine wall.

4. Placenta Circumvallata (5%):

   - Primarily diffuse but secondarily discoid to one anterior or posterior uterine wall.
   - May result from cornual ovular implantation possibly in 10%.

5. Placenta Membranacea:

   Diffuse at all stages.

OBSERVATION

The observation made during the present study of 50 placental specimens with relevance to the

- Shape of Placenta.
- Diameter of Placenta.
- Thickness of Placenta.
- Weight of Placenta.
- Maternal and Fetal Cotyledons.
- Attachment of cord
- Vascular Pattern of the Placenta.

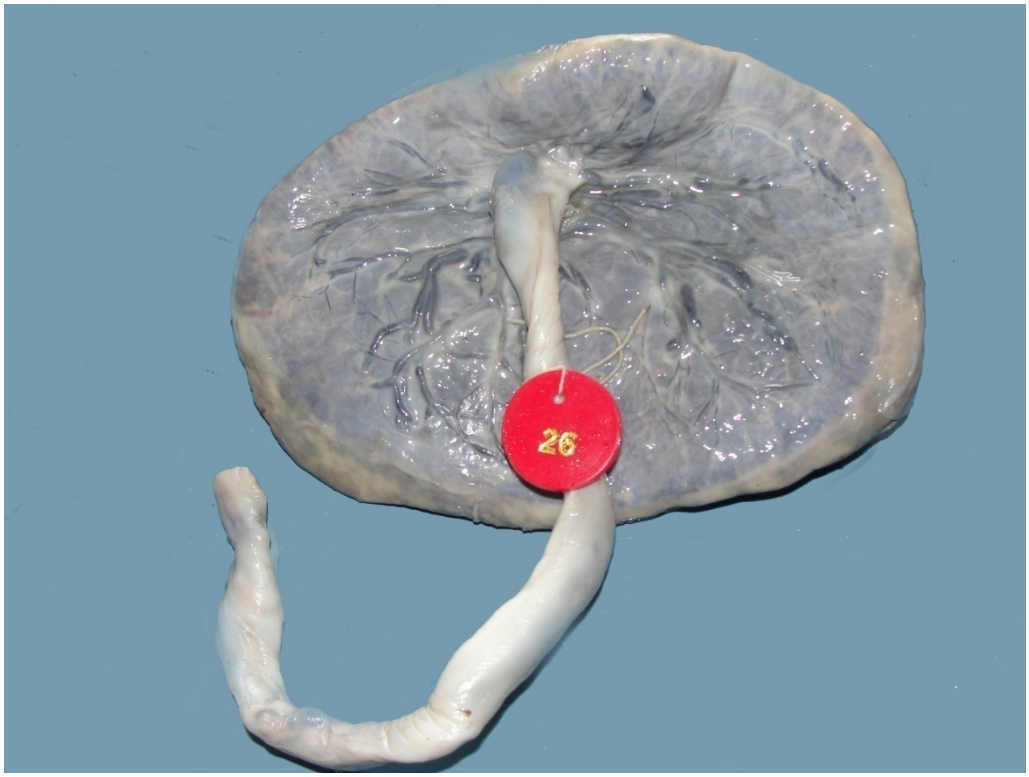
Shape of the placenta:

Shape of the placenta	Number of placenta	Percentage (%)
Circular	30	60%
Oval	19	38%
Triangular	1	2%
Total	50	

Out of the 50 placenta, 30 placenta were circular (60%), 19 placenta were oval (38%) and one placenta was triangular in shape (2%).

SHAPE OF PLACENTA - CIRCULAR

SHAPE OF PLACENTA - OVAL



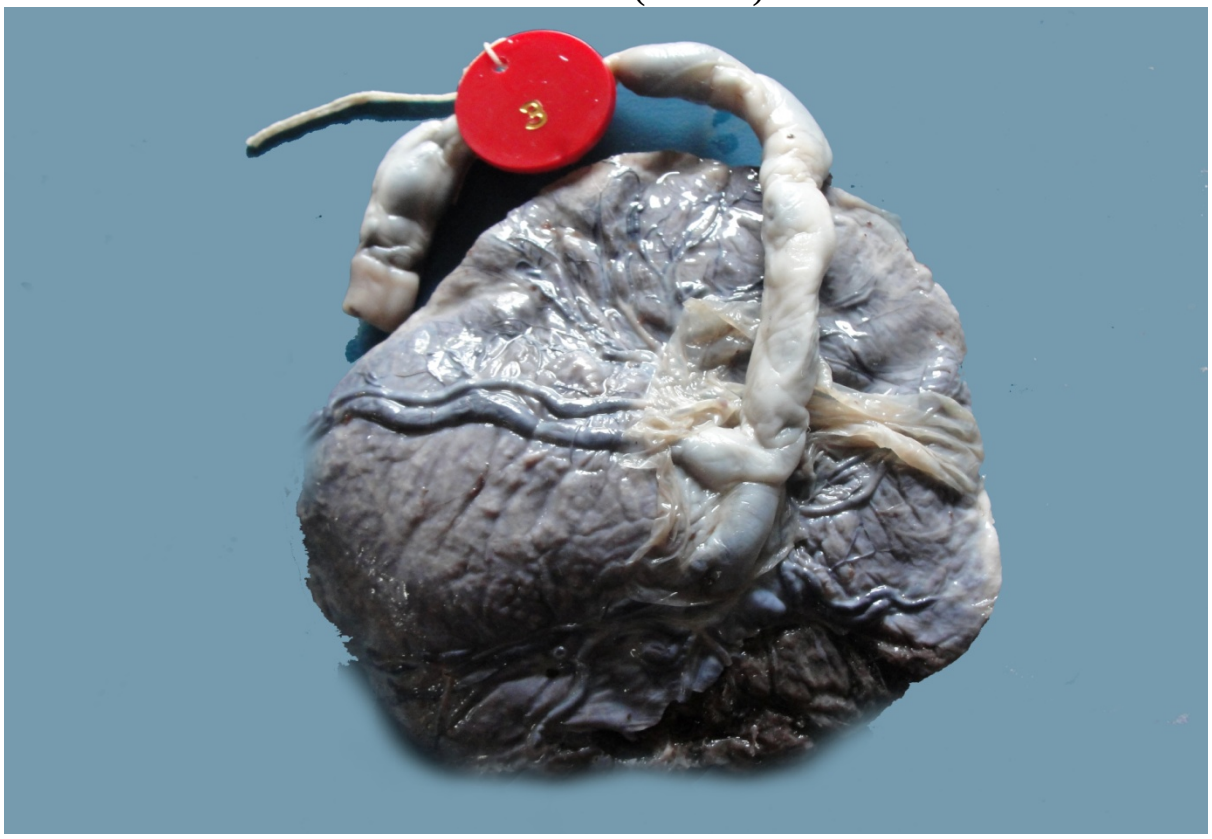
SHAPE OF PLACENTA - TRIANGULAR

DIAMETER OF THE PLACENTAE

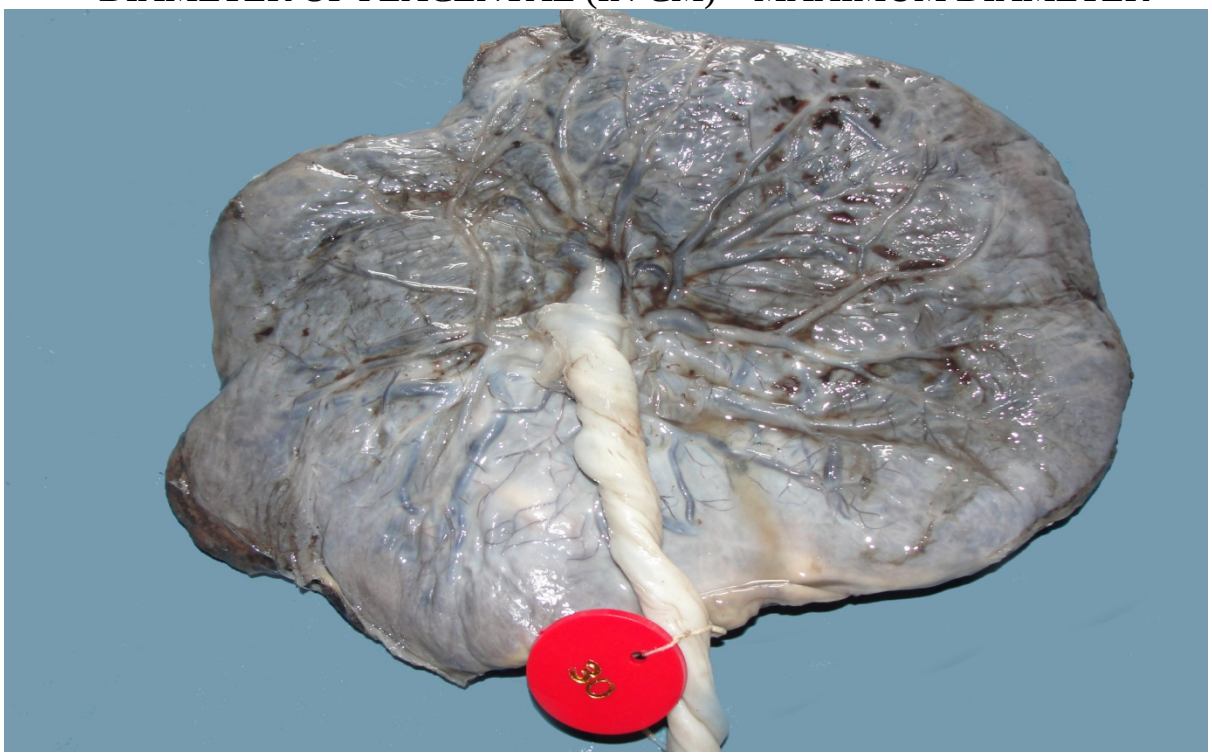
S.No	Diameter of the placenta(in cms)	Number of placenta	Percentage (%)
1	16.7	4	8%
2	14.6	1	2%
3	16.3	1	2%
4	17.4	2	4%
5	15.8	1	2%
6	16.4	1	2%
7	17.2	2	4%
8	18.4	1	2%
9	17.1	2	4%
10	18.5	2	4%
11	18.7	1	2%
12	19.7	3	6%
13	19.4	2	4%
14	18.1	1	2%
15	16.6	2	4%
16	19.5	2	4%
17	17.8	3	6%
18	20.9	1	2%
19	15.9	1	2%
20	18.0	1	2%
21	17.3	3	6%
22	16.8	2	4%
23	17.7	1	2%
24	18.6	1	2%
25	16.9	2	4%
26	17.6	2	4%
27	19.3	1	2%
28	17.0	1	2%
29	17.5	1	2%
30	18.9	1	2%
31	19.2	1	2%

Out of the fifty placentae the diameter varied from 14.60 – 20.90 cms. The maximum diameter is 20.90 cms and minimum diameter is 14.60 cms.

DIAMETER OF THE PLACENTAE (IN CM) – MINIMUM DIAMETER



DIAMETER OF PLACENTAE (IN CM) – MAXIMUM DIAMETER



THICKNESS OF THE PLACENTAE

Thickness of the placenta (in cms)	Number of placenta	Percentage (%)
1.877	3	6%
2.296	2	4%
1.612	2	4%
1.617	1	2%
1.960	3	6%
2.516	1	2%
2.070	5	10%
2.210	7	14%
1.667	1	2%
2.111	7	14%
1.925	6	12%
1.812	2	4%
1.717	4	8%
2.197	3	6%
1.766	3	6%

Out of the 50 placentae the thickness varied from 1.612cms – 2.516 cms. As shown in above table. The minimum thickness is 1.612 cms and maximum thickness is 2.516 cms.

THICKNESS OF PLACENTAE (IN CM) – MAXIMUM THICKNESS

THICKNESS OF PLACENTAE (IN CM) – MINIMUM THICKNESS

WEIGHT OF THE PLACENTAE

S.no	Weight of the placenta(in grams)	Number of placenta	Percentage (%)
1	510	2	4%
2	375	1	2%
3	425	3	6%
4	405	1	2%
5	435	2	4%
6	490	4	8%
7	450	10	20%
8	470	3	6%
9	540	2	4%
10	500	4	8%
11	480	2	4%
12	475	2	4%
13	465	2	4%
14	420	1	2%
15	495	2	4%
16	460	4	8%
17	525	2	4%
18	505	3	6%

Out of the 50 placenta, the weight of the placenta varied from 375 - 540 gms. The maximum weight of 540 gms observed in 4% of cases. The least weight of 375 gms is observed in one case.

WEIGHT OF THE PLACENTAE (IN GRAMS) – MAXIMUM WEIGHT

WEIGHT OF THE PLACENTA (IN GRAMS) – MINIMUM WEIGHT

FETO –PLACENTAL WEIGHT RATIO & PLACENTAL CO-EFFICIENT

S.no	Weight of the foetus (in grams)	Weight of the placenta (in grams)	Feto:placental ratio	Placental co-efficient
1	3200	510	6.27	0.16
2	2100	375	5.6	0.18
3	2200	425	5.17	0.19
4	2250	405	5.5	0.18
5	2650	435	6.0	0.16
6	2750	490	5.6	0.18
7	2000	450	4.4	0.22
8	2700	490	5.5	0.18
9	3100	470	6.5	0.14
10	3200	540	5.9	0.17
11	2900	500	5.8	0.17
12	2900	480	6.0	0.16
13	2600	435	5.9	0.17
14	2400	475	5.1	0.20
15	2900	450	6.4	0.16
16	2100	465	4.5	0.22
17	3100	450	6.8	0.15
18	2500	450	5.5	0.18
19	2200	465	4.7	0.21
20	2300	420	5.4	0.18
21	2800	425	6.5	0.15
22	2700	425	6.3	0.16
23	3000	450	6.6	0.15
24	2600	500	5.2	0.19
25	2700	450	6.0	0.17
26	2800	500	5.6	0.18
27	3000	495	6.0	0.17
28	3300	475	6.9	0.14
29	3500	460	7.6	0.13
30	3000	450	6.6	0.15
31	3250	525	6.1	0.16
32	2600	480	5.4	0.18
33	2300	450	5.1	0.20
34	2800	460	6.0	0.16

FETO –PLACENTAL WEIGHT RATIO & PLACENTAL CO-EFFICIENT

S.no	Weight of the foetus in grams	Weight of the placenta in grams	Feto: placental ratio	Placental co-efficient
35	2200	450	4.8	0.20
36	2700	460	5.8	0.17
37	3250	450	7.2	0.14
38	2000	460	4.3	0.33
39	2700	505	5.3	0.19
40	2900	540	5.3	0.19
41	2800	500	5.6	0.18
42	3200	525	6.0	0.16
43	2400	510	4.7	0.21
44	3500	505	6.9	0.14
45	3000	490	6.1	0.16
46	2500	470	5.3	0.19
47	2750	490	5.6	0.18
48	2400	470	5.1	0.20
49	3000	505	5.9	0.21
50	3300	495	6.6	0.15

The feto - placental ratio observed in 50 cases ranged between 4.3 – 7.6 and the placental co-efficient varied between 0.14 – 0.23.

PLACENTAL COTYLEDONS

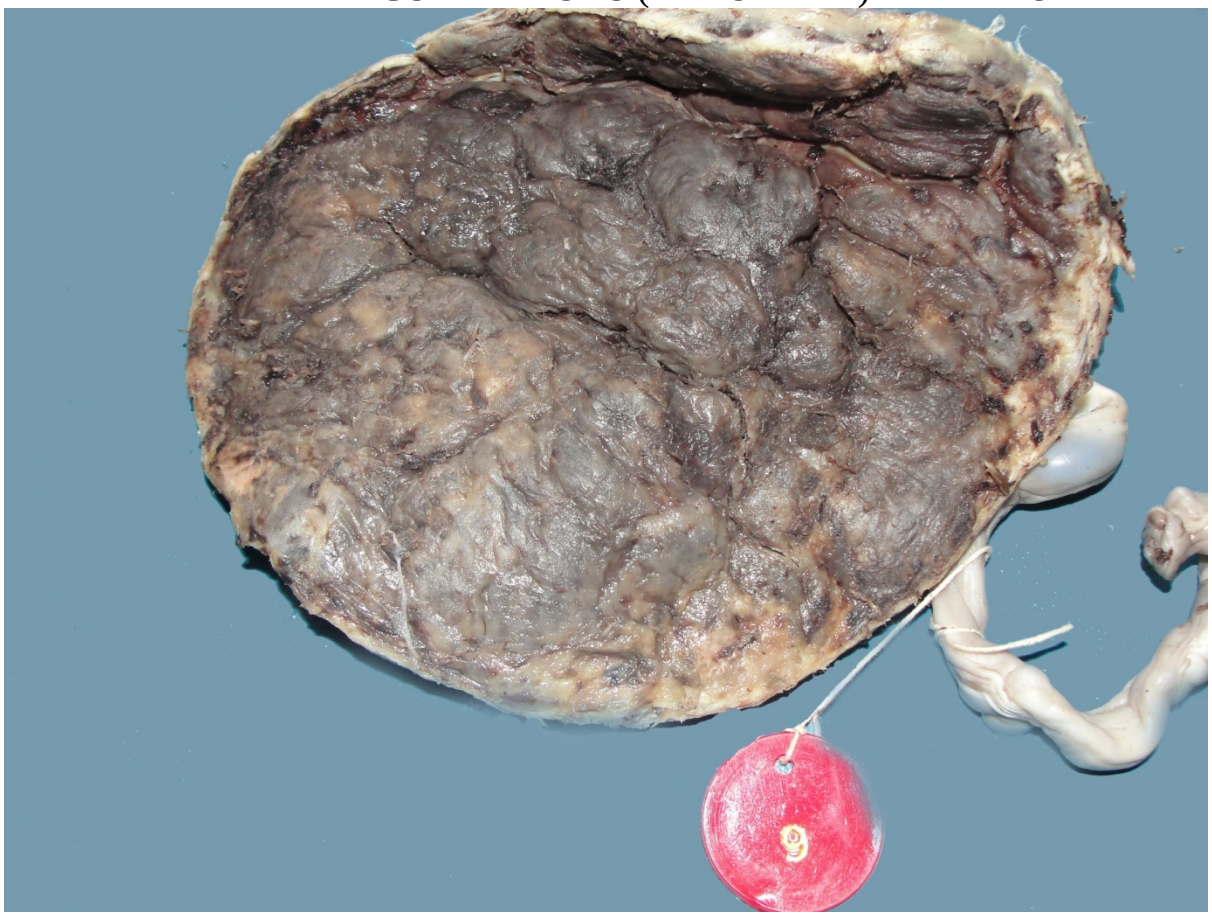
S.no	Number of maternal cotyledons	Number of fetal cotyledons	M:F ratio
1	18	62	3:4
2	14	54	3:8
3	17	51	3:0
4	16	62	3:8
5	15	48	3:2
6	18	52	2:9
7	15	62	4:1
8	18	78	4:3
9	18	82	4:5
10	20	60	3:0
11	14	48	3:4
12	18	68	3:7
13	20	64	3:2
14	18	62	3:4
15	15	42	2:8
16	16	54	3:4
17	18	68	3:7
18	18	54	3:0
19	16	54	3:4
20	18	64	3:5
21	17	51	3:0
22	17	54	3:1
23	16	70	4:3
24	18	66	3:6
25	15	68	4:5
26	18	82	4:5
27	16	64	4:0
28	20	56	3:4
29	17	62	3:5
30	15	40	2:6
31	20	62	3:1
32	18	58	3:2
33	17	62	3:5

S.no	Number of maternal cotyledons	Number of fetal cotyledons	M:F ratio
34	15	40	2:6
35	17	68	4:0
36	14	52	3:7
37	20	71	3:5
38	18	56	3:1
39	15	42	2:8
40	14	38	2:7
41	16	69	4:3
42	18	84	4:6
43	12	36	3:0
44	19	45	4:2
45	15	52	3:4
46	16	68	4:2
47	17	54	3:1
48	16	52	3:2
49	18	56	3:1
50	16	68	4:2

Out of the fifty placental specimens, the number of maternal cotyledons ranged between 12 to 20 and fetal cotyledons ranged from 36 to 84. The ratio of maternal to fetal cotyledon ranged between 2.6 to 4.6.

MATERNAL COTYLEDONS (IN NUMBER) – MAXIMUM

MATERNAL COTYLEDONS (IN NUMBER) – MINIMUM



FETAL COTYLEDONS (IN NUMBER) – MAXIMUM

FETAL COTYLEDONS (IN NUMBER) – MINIMUM

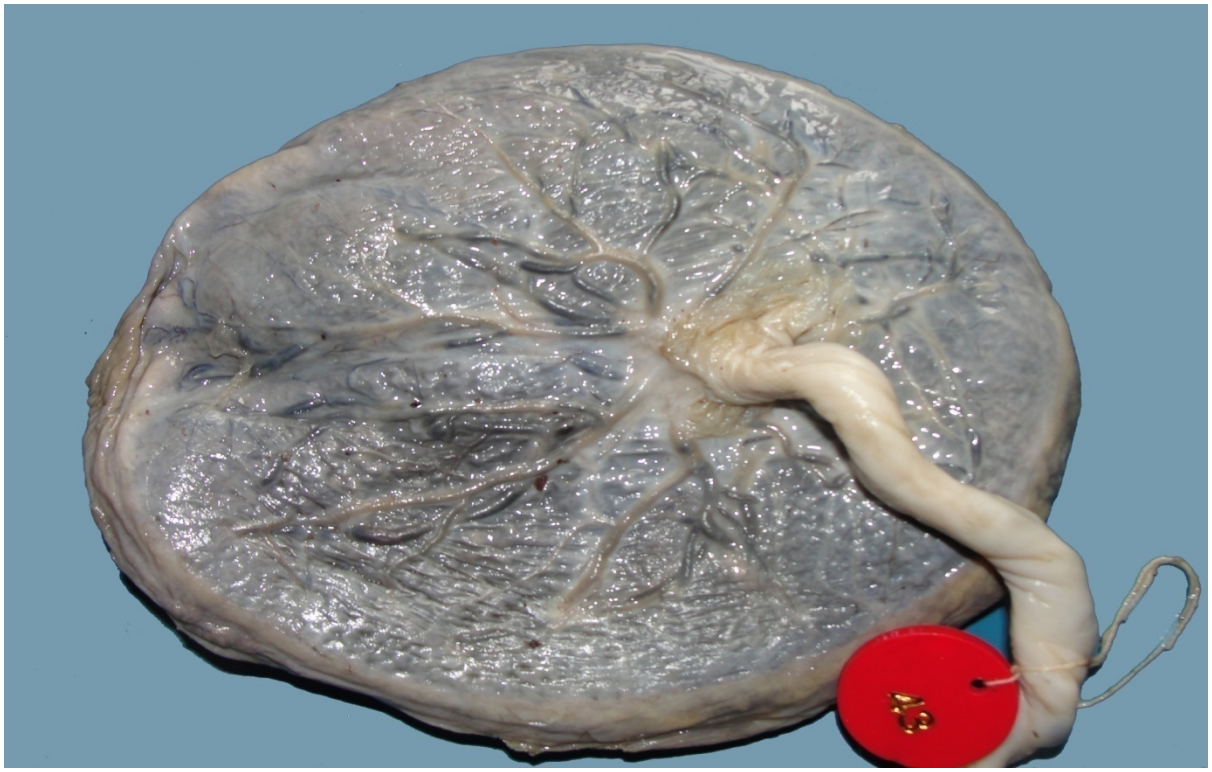
Attachment of Cord

Type of attachment	Number of placentae	Percentage
Central	13	26%
Eccentric	27	54%
Marginal	09	18%
Velamentous	01	02%

Out of the fifty placental specimens, Central attachment was observed in 26% of cases, Eccentric attachment in 54%, Marginal attachment in 18% and Velamentous attachment in 02% of cases.

ATTACHMENT OF CORD – CENTRAL

ATTACHMENT OF CORD – ECCENTRIC



ATTACHMENT OF CORD – MARGINAL

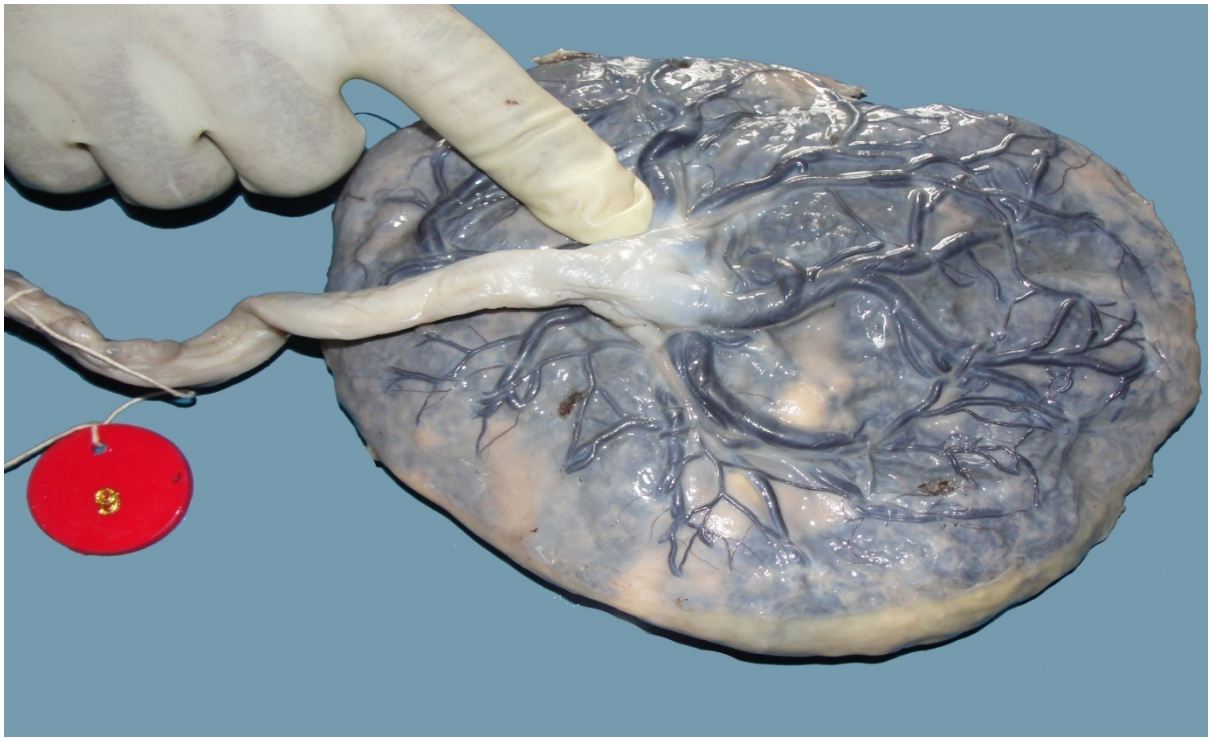
ATTACHMENT OF CORD – VELAMENTOUS

Vascular Pattern of Placenta

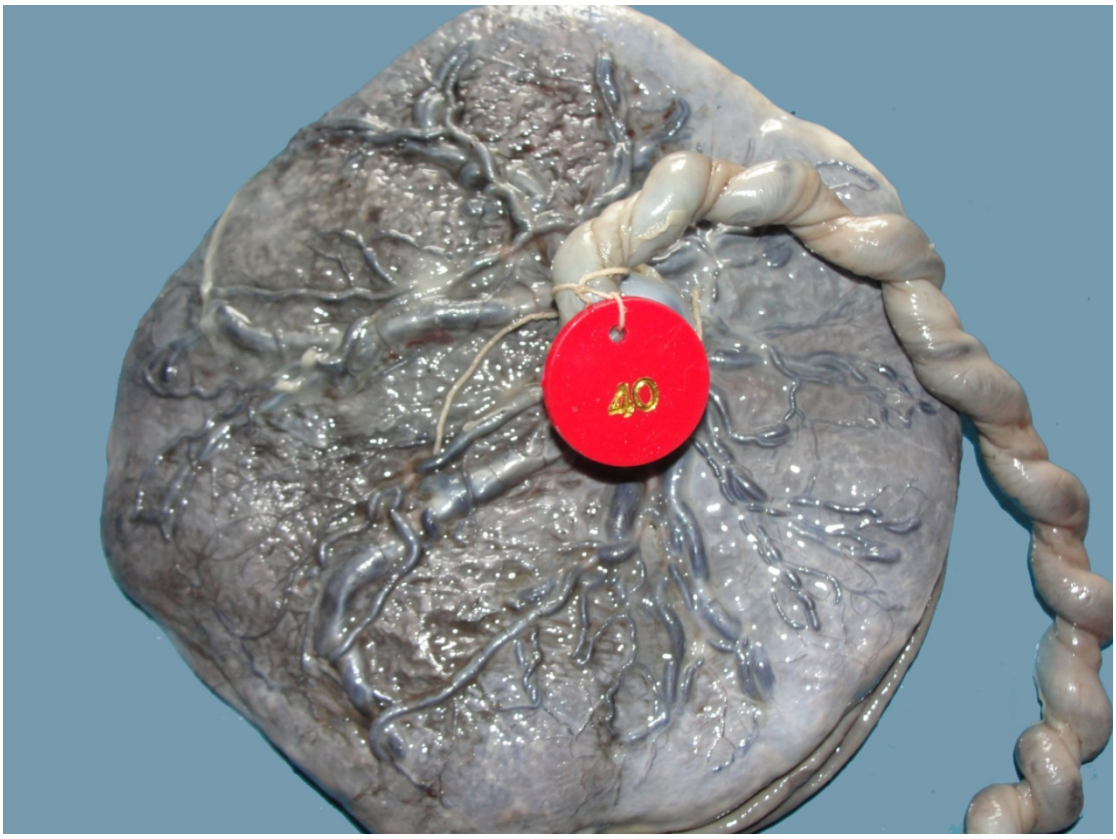
Type of vascular pattern	Number of placentae	Percentage
Disperse	32	64%
Magistral	07	14%
Mixed	11	22%

Out of the 50 placental specimens, Disperse type of vascular pattern was observed in 64%, Magistral type was observed in 14% and Mixed type was observed in 22% of cases.

VASCULAR PATTERN OF PLACENTA – DISPERSE



VASCULAR PATTERN - MAGISTRAL



VASCULAR PATTERN – MIXED

DISCUSSION

In the person study , the following observations were made with relevance to the,

- Shape of Placenta.
- Diameter of Placenta.
- Thickness of Placenta.
- Maternal and Fetal Cotyledons.
- Vascular Pattern of the Placenta.
- Attachment of cord and
- Weight of Placenta.

Of the fifty placental specimens, forty four were collected from uncomplicated pregnancies and six specimens from complicated pregnancies as shown in Table 1& 2.

Table – 1: Total Specimens

Specimen	No. of Male Conceptus Placenta	No. of female conceptus Placenta	Total
44 uncomplicated pregnancy	26	18	44
6 complicated pregnancy	1	5	6
Total	27	23	50

Total Specimens

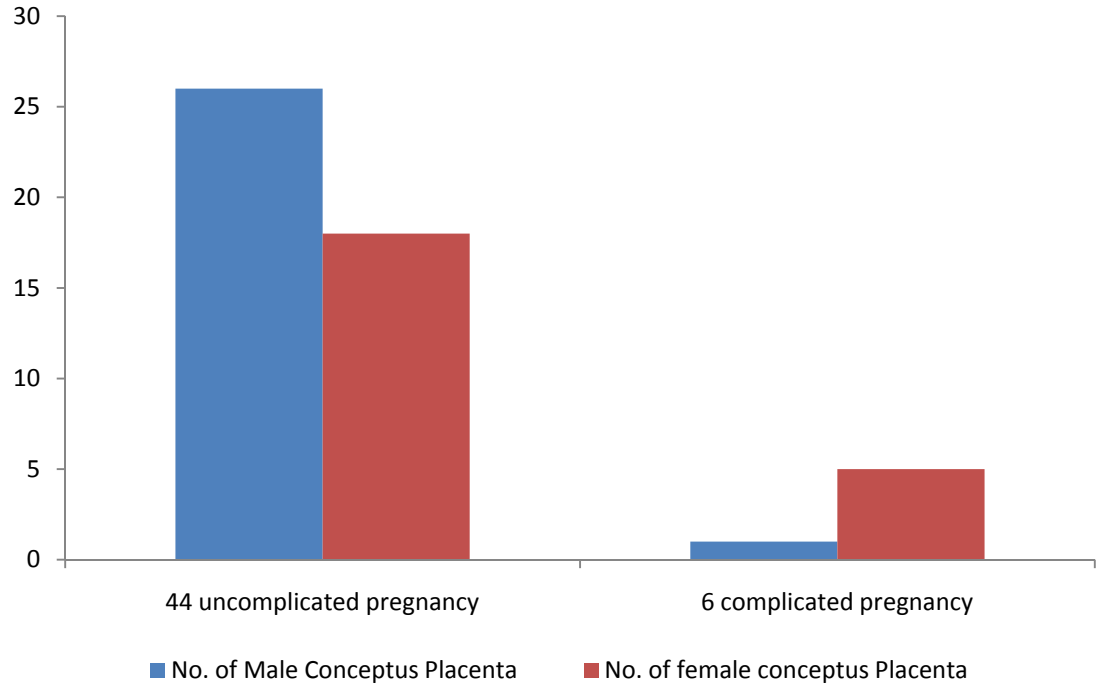
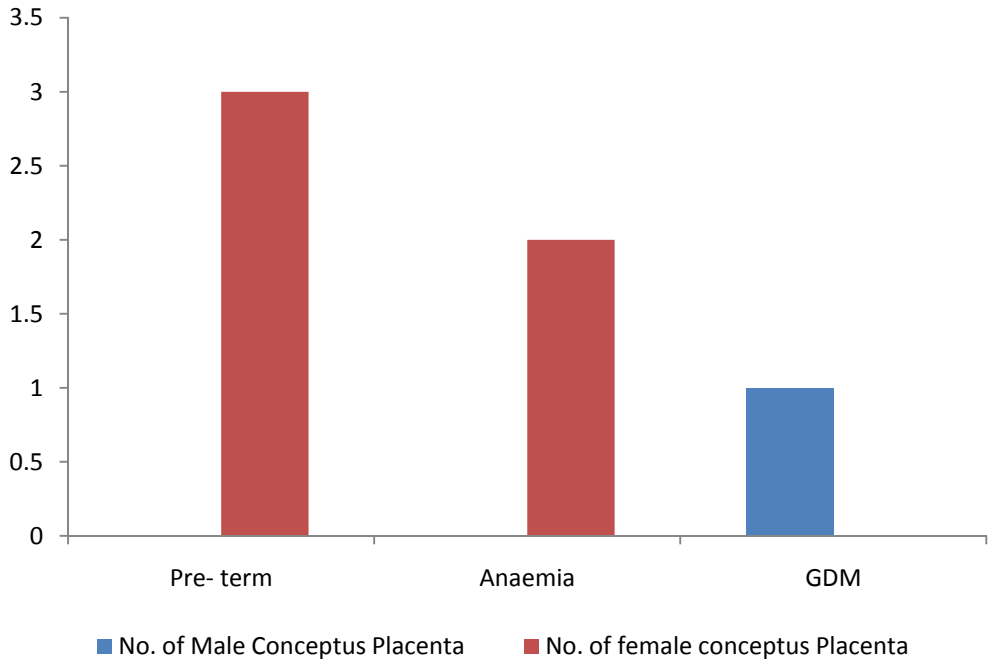


Table – 2: Factors Complicating Pregnancy

Factors complicating pregnancy	No. of Male Conceptus Placenta	No. of female conceptus Placenta	Total
Pre- term	-	3	3
Anaemia	-	2	2
Gestational Diabetes Mellitus	1	-	1
Total	1	5	6

Factors Complicating Pregnancy



Shape of the placenta:

The shape of the placenta was analyzed and observations were tabulated as shown in Table 3. The findings were,

Circular:

In the present study of 50 specimens, 30 circular shape placentae were observed. Out of the 30 circular shape placentae, 27 circular shape placentae was found in uncomplicated pregnancies (17 male, 10 female) and 3 circular shape placentae was observed in complicating pregnancy. The percentage of circular placenta was 60%. The incidence of percentage is similar to **Sarojamma** (1986)[69] and varies from **Gunapriya R**. (2001)[35]

Oval:

In the present study 19 oval shape placentae were noted, of which 16 oval shape placentae were observed in uncomplicated pregnancies (8 male, 8 female) and 3 from complicating pregnancies. The percentage of oval placenta was 36%. This finding coincides with **Sarojamma** (1986)[69] and greater than **Gunapriya.R**(2001)[35].

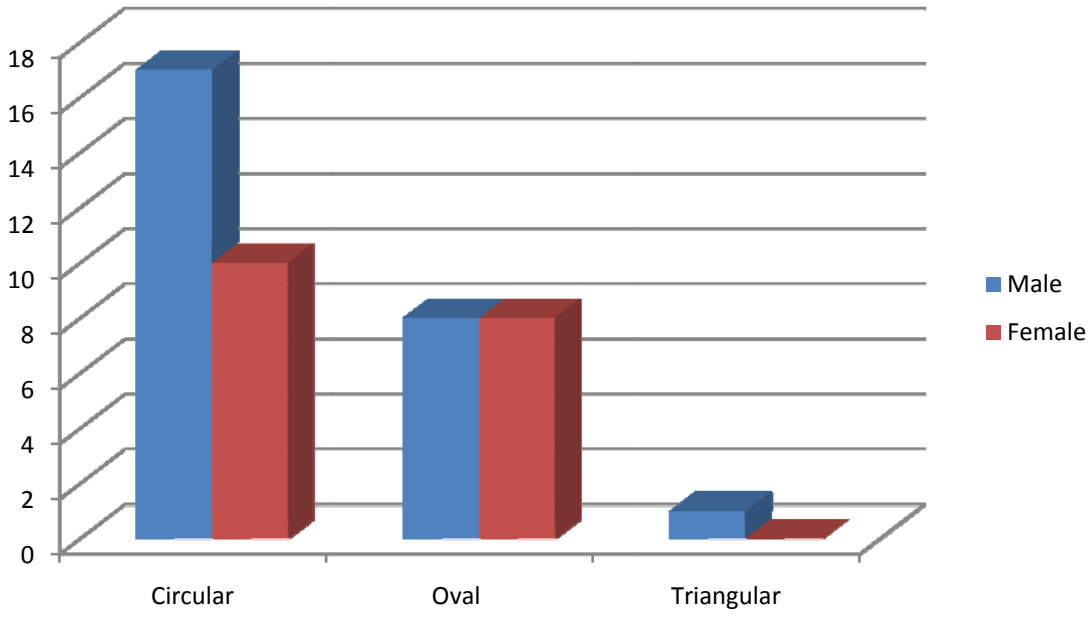
Triangular:

1 triangular placenta was observed in this study which is from uncomplicated pregnancies. The percentage of triangular placenta in the present study was 02%. This value is less than that of **Sarojamma**(1986)[69].

Table – 3: Shape of Placenta

Shape of placenta	Uncomplicated pregnancies			Complicated pregnancies			Total number of placental specimen
	Male	Female	Total	Male	Female	Total	
Circular	17	10	27	1	2	3	30
Oval	8	8	16	-	3	3	19
Triangular	1	-	1	-	-	-	1
Total							

Shape of Placenta



Diameter of the Placenta: (Table 4)

a) **Average Diameter of the Placenta**:

In the present study of 50 specimens, the average diameter of the placentae was observed as 17.7 cm. In male fetus placenta, the average diameter was 17.86 cm. In female fetus placenta, the diameter averaged 17.64 cm.

In 44 uncomplicated cases the average diameter of the placenta was observed to be 17.6 cm. In male conceptus the diameter averages 17.75 cm and in female conceptus it is 17.60 cm.

In 6 complicated pregnancies the diameter averages 17.8 cm. In male conceptus placenta the average diameter is 18.50 cm and in female conceptus placenta the diameter is 17.74 cm.

The least diameter was observed in preterm delivered placenta (14.60 cm) and the maximum diameter were noted in anaemia complicating pregnancy (20.90 cm).

In the present study, the average diameter is more than**Leslie. B. Arey**(1924)[54] and **Gunapriya. R**. (2001)[35] and is less than **Henry Gray** (1958)[39], **J.D. Boyd** and **W.J. Hamilton** (1970)[12] and **Richard S. Snell** (1973)[63]. The average diameter of the complicated pregnancies is more than the normal pregnancies.

b) Range of Placental Diameter:

In the present study of 50 placental specimens, the diameter of the placentae ranges from 14.60 – 20.90 cm. In male conceptus it is 16.7 to 19.70 cm and in female conceptus it is 14.60 to 20.90 cm.

The diameter of the placenta in 44 uncomplicated pregnancies ranges from 15.80 to 19.70 cm. In male conceptus it is 16.70 to 19.70 cm and in female conceptus it is 15.80 to 19.70 cm.

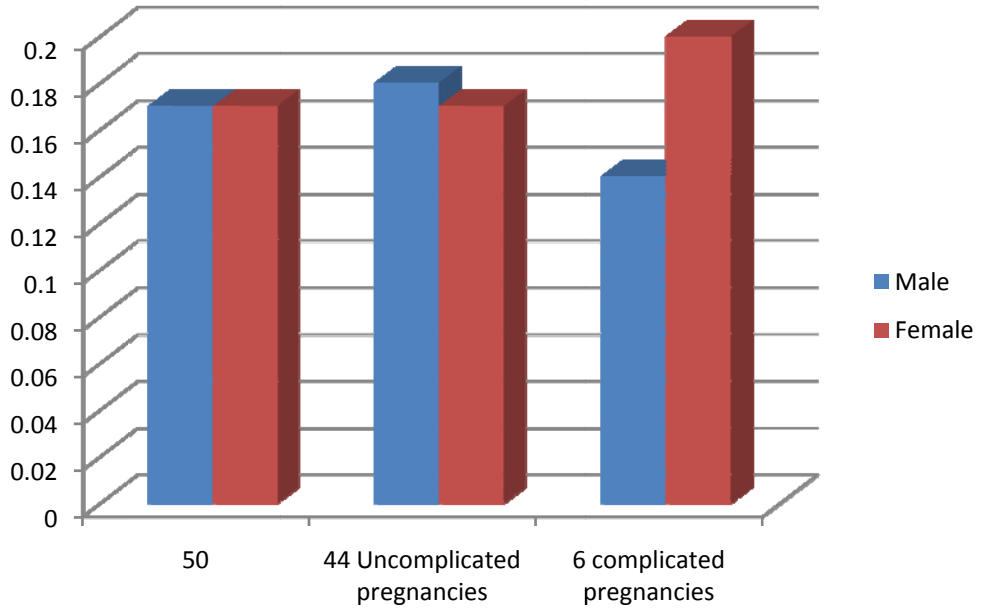
In 6 complicated pregnancies ranges from 14.60 to 20.90 cm. In male conceptus it is 18.50 cm and in female conceptus it is 14.60 to 20.90 cm.

This finding is similar to **Henry Gray**(1858)[39], **T.W.Sadler**(1963)[66],**Keith LMoore** and **T.V.N.Presaud**(1973)[47] and**Gunapriya. R** (2001)[35]

Table – 4: Diameter of Placenta

Specimen	Average diameter (in cm)			Range of diameter (in cm)		
	Total	Male	Female	Total	Male	Female
50	17.7	17.86	17.64	14.60-20.90	16.7-19.70	14.60-20.90
44 Uncomplicated pregnancies	17.6	17.75	17.6	15.80-19.70	16.70-19.70	15.80-19.70
6 complicated pregnancies	17.8	18.50	17.74	14.66-20.90	18.50	14.60-20.90

Diameter of Placenta



Thickness of the Placenta: (Table 5)

a) **Average Thickness of Placenta**:

The average thickness of the placenta in the present study is 1.993cm. In male conceptus placenta is 2.017 cm and in female conceptus it is 1.964 cm.

In 44 uncomplicated pregnancies the average thickness is 1.98 cm. In male conceptus the average thickness is 2.015 cm and in female conceptus it is 1.947 cm.

In 6 complicated pregnancies the average thickness is 2.0 cm. In males it is 2.070 cm and in female it is 2.0cm.This finding is similar to **K.Benirschke et al** (1967)[9], **J.D.Boyd and W.J.Hamilton**(1970)[12] and **Gunapriya.R.**(2001)[35].

The thickness of the placenta is **increased** in **diabetes mellitus** and **reduced** in **anaemia** and **prematurity**.

b) **Range of Thickness of Placenta**:

The range of placental thickness in the present study is 1.612 to 2.516 cm. In male conceptus the range observed is 1.667 to 2.516 cm and in female conceptus it is 1.612 to 2.296 cm.

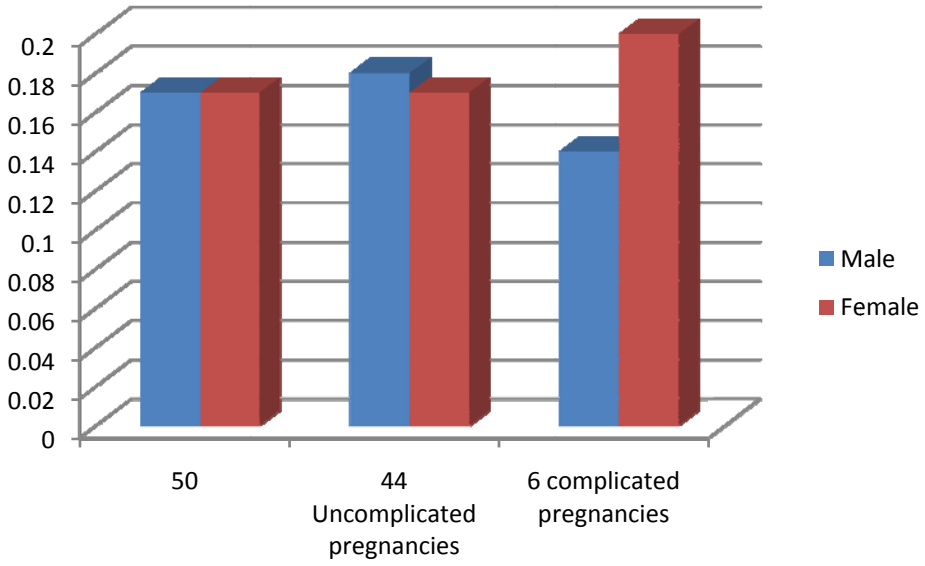
In 44 uncomplicated pregnancies, the range is 1.612 to 2.516 cm. In males conceptus the observed range is 1.667 to 2.516 cm and in female conceptus the range is 1.617 to 2.296 cm.

In 6 complicated pregnancies, the range observed is 1.612 to 2.296 cm. In female the range is 1.612 to 2.296 cm. This findings coincides with **HenryGray**(1858)[39], **Gunapriya.R**(2001)[35] and **Sarojamma** (1986)[69].

Table – 5: Thickness of Placenta

Specimen	Average thickness (in cm)			Range of thickness (in cm)		
	Total	Male	Female	Total	Male	Female
50	1.993	2.017	1.964	1.612-2.516	1.667-2.516	1.612-2.296
44 Uncomplicated pregnancies	1.98	2.015	1.947	1.612-2.516	1.667-2.516	1.617-2.296
6 complicated pregnancies	2.0335	2.070	2.026	1.612-2.296	2.070	1.612-2.296

Thickness of Placenta



Maternal Surface – Cotyleons: (Table – 6)

a) **Average Cotyledon Number**:

The average cotyledons in the present study are 17. In male conceptus the average cotyledon number is 17 and in female conceptus it is 16.

In 44 uncomplicated pregnancies the average cotyledon number is 17. In male conceptus placenta it is 17 and in female conceptus it is 16.

In 6 complicated pregnancies the average cotyledon number is 16.

In male conceptus the cotyledon number is about 20 and in femaleconceptus about 16. This finding is less than **Allan C. Barnes** (1968)[3], **Majumdar et al** (2005)[56].

The cotyledon number is **reduced** in factors complicating pregnancy such as **prematurity.**

b) **Range of Cotyledon Number**:

The range of cotyledons in the present study is 12 to 20. In male conceptus the range is 12 to 20 and in female conceptus the range is 14 to 20.

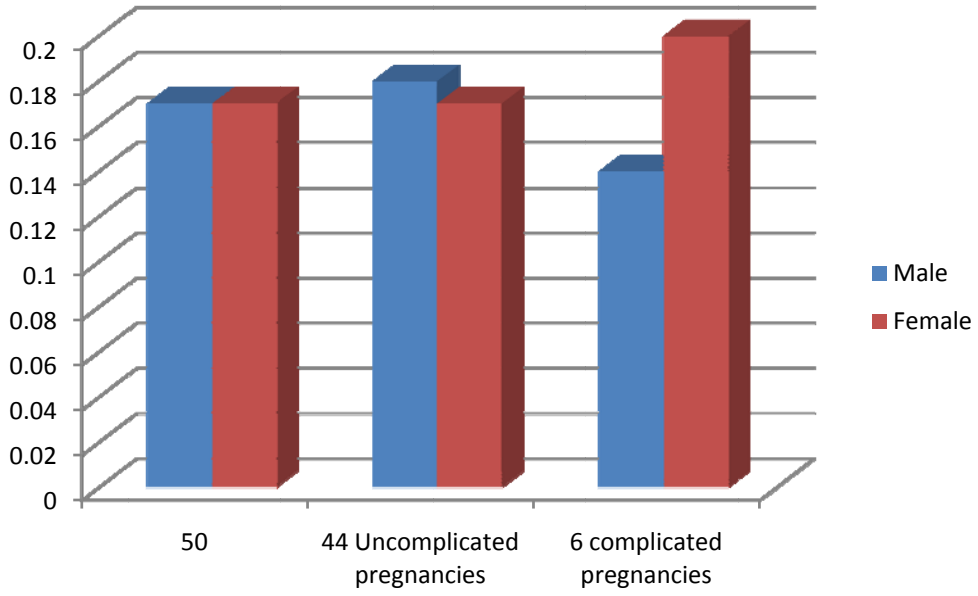
In 44 uncomplicated pregnancies, the range is 12 to 20. In male conceptus the range is 12 to 20 and in female conceptus the range is 15 to 20.

In 6 complicated pregnancies, the range is 14 to 20. In female conceptus the range is 14 to 18. This finding coincides with**K.Benirschke et al**(1967)[9], **J.D.Boyd** and**W.J.Hamilton** (1970)[12], **Gunapriya.R.**(2001)[35].

Table – 6: Maternal Cotyledons

Study	Average Cotyledon number			Range Cotyledon number		
	Total	Male	Female	Total	Male	Female
50	17	17	16	12-20	12-20	14-20
44 Uncomplicated pregnancies	17	17	16	12-20	12-20	15-20
6 complicated pregnancies	16	20	16	14-20	20	14-18

Maternal Cotyledons



Foetal Surface: A) Cotyledons: (Table 7)

a) Average Number of Cotyledons:

The average number of cotyledons in the present study is 59. In male conceptus it is 59 and in female conceptus it is 58.

In 44 uncomplicated pergnancies the average cotyledon number observed is 59 and in male it is 59 and in female it is 57.

In 6 complicated cases the average number of cotyledon observed is 60. In male it is 60 and in female it is 60. The average number of fetal cotyledons is increased in complicated pregnancies.

The above findings are less than **Gray's edited by Peter L.Williams(**2002)[32] and almost coincides with **A.K.Datta**(2000)[5].

b) **Range of Fetal Cotyledon:**

The range of fetal cotyledon in this present study is 36 to 84. In male conceptus it is 36 to 84 and in female conceptus it is 40 to 82.

In 44 uncomplicated pregnancies, the range of fetal cotyledons is 36 to 84. In male conceptus the range is 36 to 84 and in female conceptus the range is 40 to 82.

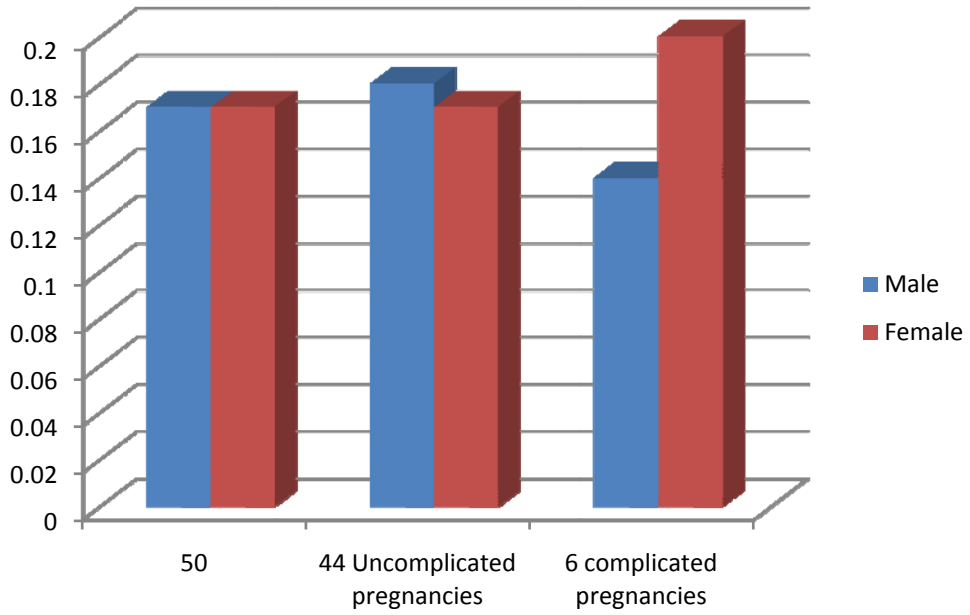
In 6 complicated pregnancies, the range of fetal cotyledons is 54 to 68. In male it is 60 and in female it is 54 to 68. The range of fetal cotyledons is increased in the present study. This finding less than that stated by**Crowford** (1959)[16] and more

than that was stated by **Hamilton, Boyd** and **Mossmans** (1966)[38] and **Gray's edited by Peter L.Williams**.(2002-2005)[32].

Table – 7: Fetal Cotyledons

Study	Average Cotyledon number			Range Cotyledon number		
	Total	Male	Female	Total	Male	Female
50	59	59	58	36-84	36-84	40-82
44 Uncomplicated pregnancies	59	59	57	36-84	36-84	40-82
6 complicated pregnancies	60	60	60	54-68	60	54-68

Fetal Cotyledons



C. **Feto-Maternal Cotyledon Ratio**:

In the present study the feto-maternal cotyledon ratio observed is 3.5. In male conceptus it is 3.5 and in female conceptus it is 3.4.

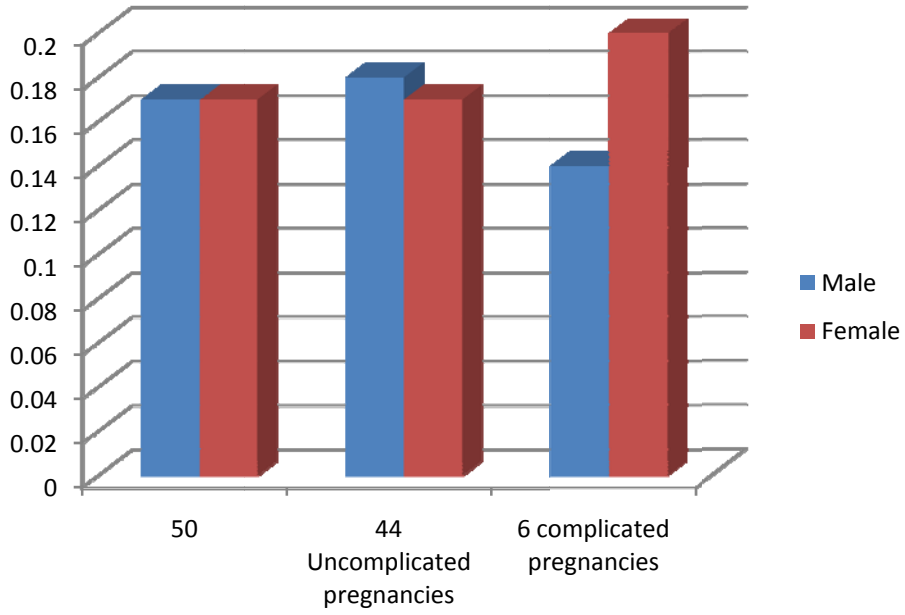
In 44 uncomplicated cases, the feto – placental cotyledon ratio is 3.5. In male conceptus it is 3.5 and female conceptus it is 3.4.

In 6 complicated cases, the feto – placental cotyledon ratio is 3.6. In male conceptus it is 3.0 and female conceptus it is 3.7. The feto – placental ratio is increased in complicated cases as in diabetes mellitus. In this present study, the findings coincides with **A.K.Datta**(2000)[5].

Table – 8: Maternal Fetal Cotyledon Ratio

Study	Maternal fetal cotyledon ratio		
	Total	Male	Female
50	3.5	3.5	3.4
44 Uncomplicated pregnancies	3.5	3.5	3.4
6 complicated pregnancies	3.6	3.0	3.7

Maternal Fetal Cotyledon Ratio



B) **Vascular Pattern of the Placenta**: (Table 11)

Vascular pattern of the placenta was observed after removal of the amnion.

(1) **Disperse Pattern**: In the present study of 50 placentas, 32 (64%) cases showed disperse pattern. This finding coincides with **Kishore.N.Sarkar**(1967)[50].

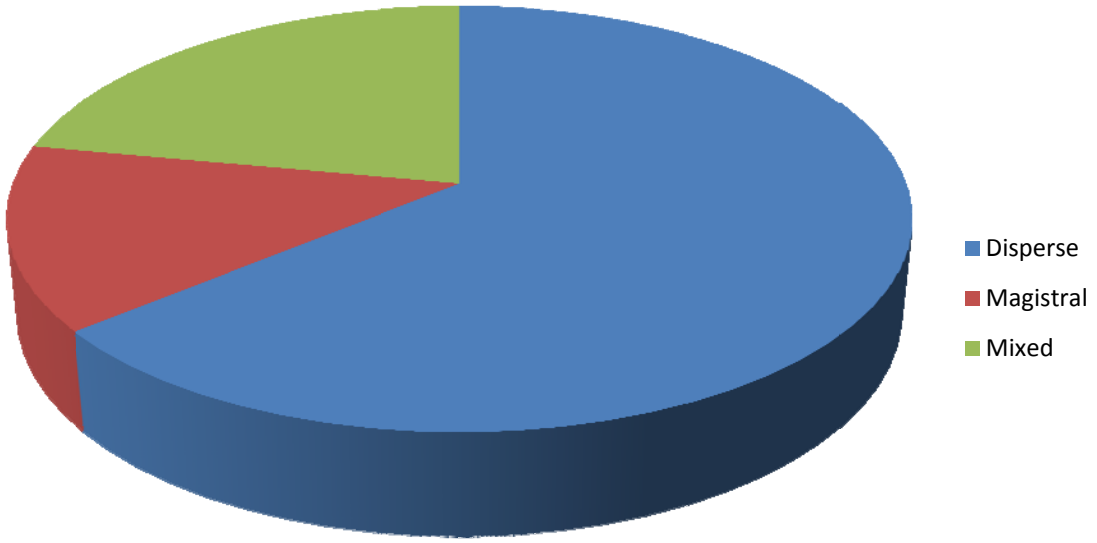
(2) **Magistral Pattern**: In the present study 7 cases (14%) were observed tohavemagistral pattern. This findings is less than **Shordania J.** (1929)[75], **P.Basich and C.F.V.Smout**(1937)[6].

(3) **Mixed Pattern**: In the present study, 11 cases (22%) of mixed pattern are observed. This finding is less than **Shordania.J**(1929)[75]**, P.Basich** and **C.F.V.Smount** (1937)[6].

Table – 11: Vascular Pattern of Placenta

S. No	Type of vascular pattern	Number of Specimen	Percentage
1	Disperse	32	64%
2	Magistral	7	14%
3	Mixed	11	22%

Vascular Pattern of Placenta



Attachment of cord: (Table 12)

(1) **Central Insertion**:

In this study of 50 placentae,central type of cord insertion was observed in 13 specimens (26%). This value coincides with **Earn.A.A**(1951)[25], **Krone H.A**(1961)[51] and more that of **Shanklin D.R** (1958)[73]**, Chiari et al**(1985)[14] and **Gunapriya** (2001)[35].

(2) **Eccentric Insertion**:

Eccentric type of cord insertion was observed in 27 specimens (54%). This finding coincides with **Hyrtl.J**(1870)[43] and less than that of **Chiari et al** (1895)[14], **Shanklin J.R**(1958)[73], **Gunapriya R** (2001)[35] and **Eastman N.J** and **Hellman L.M**(1966)[26] and more than that of **Earn. A. A** (1951)[25].

(3) **Marginal Insertion:**

Marginal type of cord insertion was observed in 9 specimens (18%). The above finding coincides with **Hyrtl.J**(1870)[43], **Earn A.A**(1951)[25]and more than that of **Eastman N.J** and **HellmannL.M**(1966)[26], **Uyanwah et al** (1977)[85] and **Thomas.J**(1963)[80].

(4) **Velamentous Insertion**:

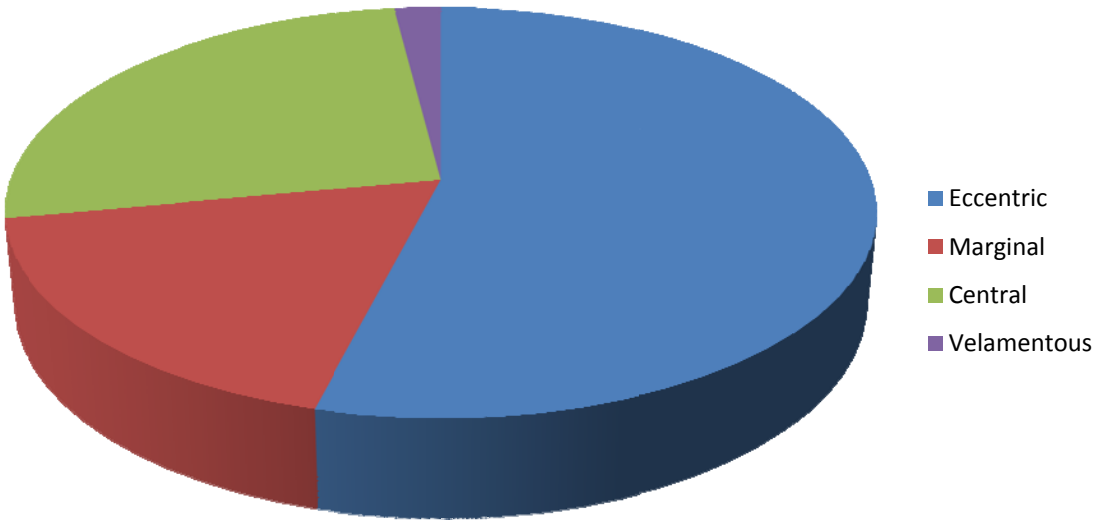
Velamentous type of cord insertion was observed in 1 specimen (2%). This finding is almost similar to **Uyanwah et al** (1977)[85], **Scott J.S**

(1960)[72], **Thomas.J**(1963)[80] and less than that of **Lefevre.G** (1896)[53] , **Shanklin.D.R** (1958)[73].

Table – 12: Attachment of Cord

S. No	Type of insertion	Number of specimen	Percentage
1	Eccentric	27	54.%
2	Marginal	9	18%
3	Central	13	26.%
4	Velamentous	1	2%

Attachment of Cord



Weight of the Placenta: (Table 9)

a) Average Weight of the Placenta:

In the present study of 50 specimens the average weight of the placenta is 471 gms. In male conceptus the average weight in the present study is 487.22 gms and in female conceptus the average is 451.95gms.

In 44 uncomplicated pregnancies the average weight of the placenta is 475.45gms. In male conceptus the average weight in uncomplicated pregnancies is 487.84 gms. In female conceptus the average weight is 457.50 gms

In 6 complicated pregnancies the average weight of the placenta is 438 gms,. In male conceptus it is 470 gms and in female conceptus the average weight is 432 gms.

This finding is similar to **Henry Gary** (1858)[39], **Shameer Singh et al** (1979)[74] and **Majumdar et al** (2005)[56]. This finding is greater than **Wong T.C.,** and **J.A.P.Lartour**(1966)[9] and less than**Kucuz M Doymaz.F**(2008)[52].

The average weight of the male and female conceptus in the present study is 489.8grams and 448.91 grams. This finding is similar to the finding of **GoshL.V** and **Chandrasekhar.C**(1948)[31] and less than that of **S.P.Gupta**(1972)[36], **Williams et al** (1969)[88], **Hamilton Boyd** (1970)[38] and **Batnagar**(1983)[7].

The average weight of the placenta in complicated pregnancies like prematurity and anaemia were decreased and the average of the placenta were increased in diabetes mellitus.

b) **Range of Placental Weight**:

The range of the placental weight in this present study is 375 to 540gms. In male conceptus it is 425 to 540 grams and in female conceptus it is 375 to 540 grams.

In 44 uncomplicated pregnancies the range of the placental weight is 405 to 540 grams. in male conceptus it is 425 to 540 grams and in female it is 405 to 500 grams.

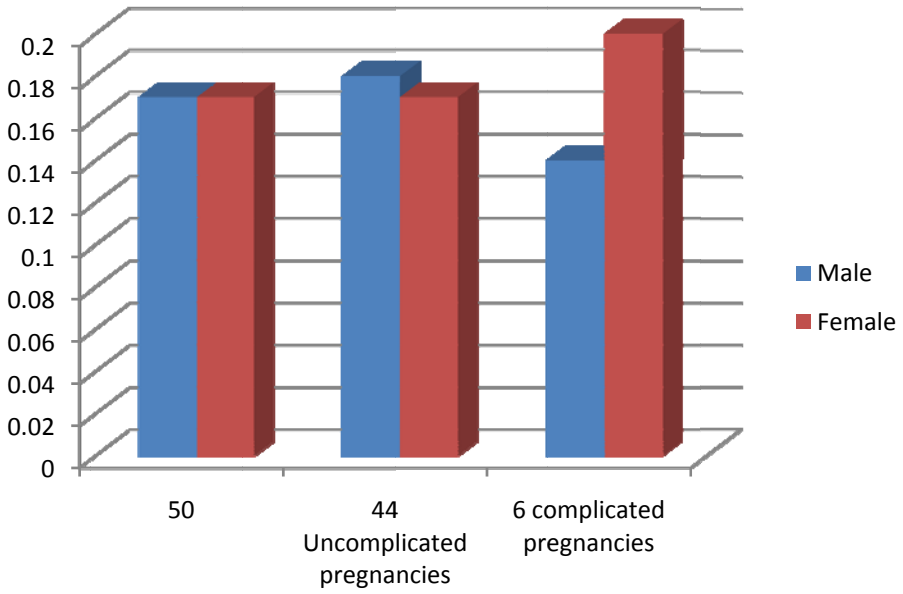
In 6 complicated cases, the range of the placental weight is 375 to 540 grams. In male it is 540 grams and in female it is 375 to 465 grams.

This finding is similar to the finding of **Henry Gray** (1858)[39], **Benirchke** (1967)[9] and **Kaplan C. G** (1996)[46].

Table – 9: Weight of Placenta

Study	Average Placental weight (in gm)			Range of Placental weight (in gm)		
	Total	Male	Female	Total	Male	Female
50	471	489.81	448.71	375-540	425-540	375-540
44 Uncomplicated pregnancies	475.45	487.84	453.6	405-540	425-540	405-500
6 complicated pregnancies	438	540	432	375-540	540	375-465

Weight of Placenta



Placental weight in relation with fetal weight:

In the present study the average weight of the placenta and conceptus is 471 grams and 2.74 kgs. Placental weight is 1/5.805 the weight of the conceptus.

The placental weight in 44 uncomplicated pregnancies is 1/5.8 of the weight of the fetus. In male conceptus it is 1/5.724 and in female it is 1/5.842.In 6 complicated cases, the observation is 1/5.1. In male it is 1/5.9 and in female it is 1/ 4.94. This finding is less than that of the **Adair.F.L** and **Thealander.H**(1946)[1] and **Keith L Moore** and **T.V.N.Persaud**(1973)[47].

Table – 10: Weight of the Conceptus

Study	Weight of the conceptus in (kg) average			Weight of the conceptus in (kg) range		
	Total	Male	Female	Total	Male	Female
50	2.74	2.822	2.643	2.0-3.5	2.0-3.5	2.0-3.5
44 Uncomplicated pregnancies	2.79	2.807	2.783	2.0-3.5	2.0-3.5	2.1-3.5
6 complicated pregnancies	2.316	3.21	2.14	2.0-3.2	3.2	2.0-2.3

Weight of the Conceptus

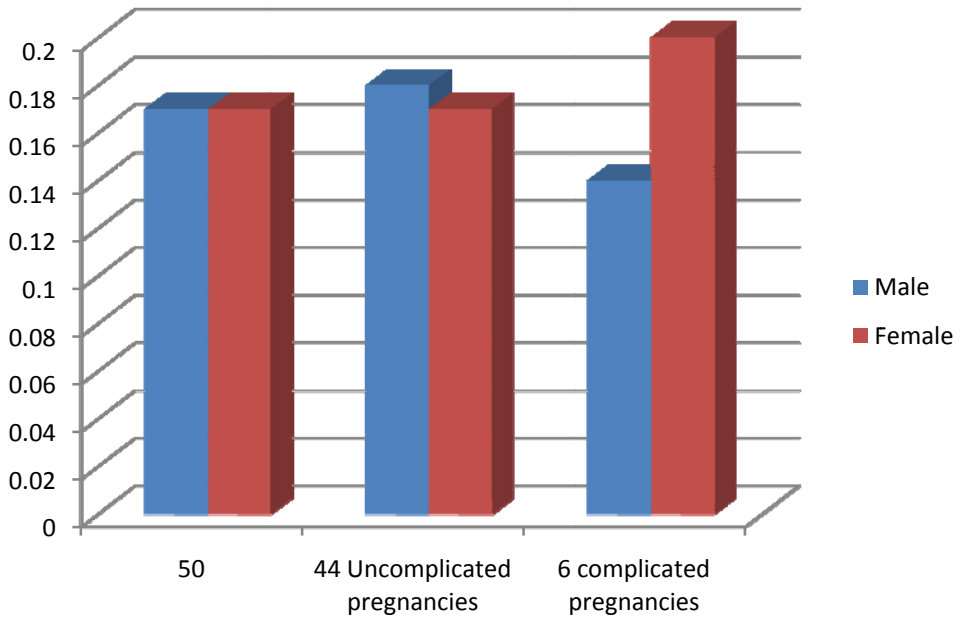
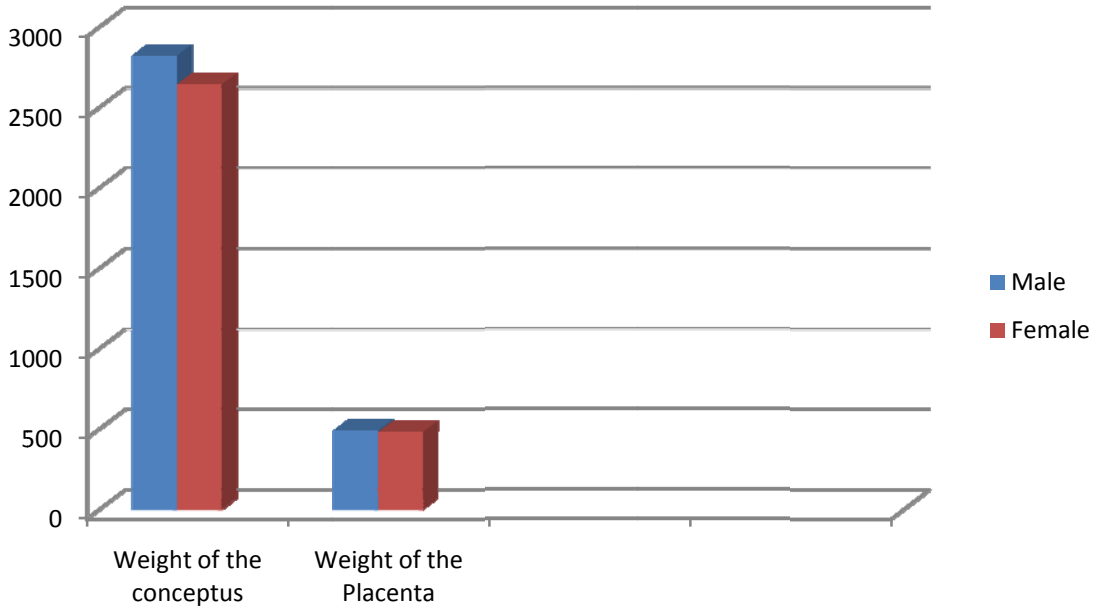


Table – 10 B: Weight of the Placenta in Relation to the Weight of the Conceptus

Study	No of conceptus	Weight of the conceptus (kg)		Weight of the placenta (gm)	
		Average	Range	Average	Range
Male	27	2.822	2.0-3.5	489.87	425-540
Female	23	2.643	2.0-3.5	481.91	375-540

Weight of the Placenta in Relation to the Weight of the Conceptus



Feto – Placental Ratio (F:P): (Table 10 C)

The average Fetoplacental ratio in the present study is 5.805:1. FetoPlacental ratio is male conceptus is 5.76:1 and in female conceptus it is 5.85:1.

In 44 uncomplicated pregnancies the average fetoplacental ratio is 5.8:1 and in male conceptus the ratio is 5.71:1 and in female conceptus it is 6.0:1.

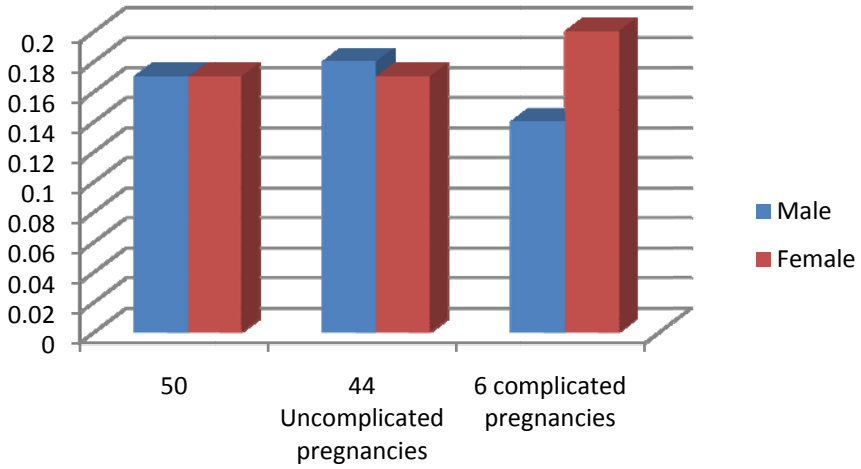
In 6 complicated pregnancies, the average feto-placental ratio is 5.25:1. In male conceptus it is 6.8:1 and in female conceptus it is 4.94:1.

This finding is similar to that of **Lurie.S et al** (1999)[55] and **Majumdaret al** (2005)[56]. Male and female feto placental ratio does not vary much and this finding agrees with **Lurie.S et al** (1999)[55]. The feto placental ratio is increased in diabetes mellitus and decreased in prematurity.

Table – 10 C: Feto Placental Ratio

Study	Feto - placental ratio (FW/ PW) (FP) average		
	Total	Male	Female
50	5.805	5.724	5.842
44 Uncomplicated pregnancies	5.8	5.71	6.1
6 complicated pregnancies	5.1	5.9	4.94

Feto Placental Ratio



Placental Co – Efficient: (Table 10 D)

The average placental coefficient in the present study of 50 placentae is 0.18. In male conceptus, it is 0.17 and in female conceptus it is 0.17.

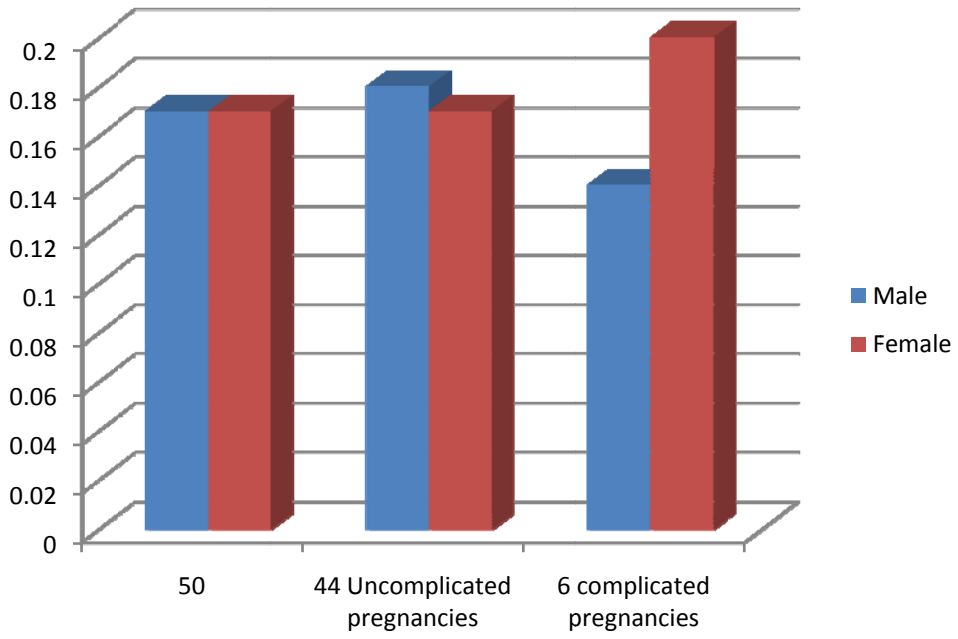
In 44 uncomplicated pregnancies, the average placental coefficient is 0.18. In male conceptus it is 0.18 and in female conceptus it is 0.17.In 6 complicated pregnancies, it is 0.19 and in male it is 0.14 and in female it is 0.20.

This finding is similar to that of **Kucuk. M. Doymaz. F** (2008)[52] and it is less than that of **Kucuk. M. Doymaz** (2008)[52] in case of diabetes mellitus.

Table – 10 D: Placental Co – Efficient

Study	Placental co – efficient (PW/ FW) average		
	Total	Male	Female
50	0.18	0.17	0.17
44 Uncomplicated pregnancies	0.18	0.18	0.17
6 complicated pregnancies	0.19	0.14	0.20

Placental Co – Efficient



SUMMARY AND CONCLUSION

In the current study, fifty placental specimens were collected from Government Rajaji Hospital, Madurai and subjected to gross inspection and dissection method with relevance to the following parameters,

- Shape
- Diameter
- Thickness
- Weight of the placenta
- Maternal and fetal cotyledons
- Attachment of cord
- Vascular pattern
- Feto-placental ratio.

➢ **Shape** :

In this study 60% is circular in shape, 38% is oval and 2% is triangular.

➢ **Diameter :**

The mean diameter of the placenta is 17.7 cm. The diameter of the placenta is increased in anaemia up to 20.90cm and decreased to 14.6 cm in prematurity.

- **Thickness :**

The average thickness of the placenta in the present study is 1.993 cm. The thickness of the placenta is increased to 2.070 cm in diabetes mellitus and decreased in anaemia to 1.612cm.

- **Weight of the placenta :**

The average weight of the placenta in this present study is 471grams. In diabetes mellitus the weight of the placenta is increased to 540 grams and decreased in prematurity to 375 grams.

- **Maternal and fetal cotyledons :**

The average number of maternal cotyledon in the present study is 17. The cotyledon number is increased in diabetes mellitus to 20 and reduced in prematurity to 16 in number.

The average number of fetal cotyledons in the present study is 59. In normal uncomplicated pregnancies it is 59 and in complicated pregnancies it is 60. The cotyledon number is increased in diabetes mellitus up to 60.

The mean maternal-fetal cotyledon ratio in the present study is 3.5:1. The cotyledon number is increased in prematurity (4.1:1) and reduced in diabetes mellitus (3:0).

- **Attachment of cord :**

The type of cord insertion observed in this study is central in 26%, marginal in 18%, velamentous in 2% eccentric in 54%. The eccentric type is the most common in the present study (54%).

- **Vascular pattern :**

The vascular pattern of the placenta observed in this present study were Disperse type 32%, Magistral type 7% and Mixed type 22%.

- **Feto-placental ratio :**

The mean feto-placental ratio in this study is 5.805. In uncomplicated pregnancies it is 5.8 and complicated pregnancies it is 5.1. The feto placental ratio is decreased in prematurity (4.4).

The placental coefficient in this study is 0.18. In uncomplicated pregnancies it is 0.18 and in complicated pregnancies it is 0.19. The placental coefficient is increased in prematurity to 0.22.

The average weight of the conceptus in the present study is 2.74kg (in uncomplicated pregnancies – 2.79 and in complicated cases – 2.316). The weight of the conceptus is reduced in anaemia and prematurity and increased in diabetes mellitus. Thus the variations observed will be useful to the clinicians and anatomists who are doing research in this field.

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MASTER CHART

S No	Name	Age	Sex	I.p.No	Ward	Sex of the conceptus	weight of the conceptus (kg)	TYPE OF PREGNANCY	Shape of Placenta	Diameter in cm	Thickness in cm	Weight in grams	Matera cotyledons	Fetal cotyledons	M.F. Ratio	Attachment of cord	Fetoptecent ratio	Vascular pattern	Placental co -efficient
1	Pokkisam	26	F	11288	C L T	M	3.2 KG	UC	Circular	16.70	1.877	510	18	62	3:04	Central	6.27	Disperse	0.16
2	Udaya kumari	22	F	11568	C L T	F	2.2 KG	UC	Circular	16.30	1.612	425	17	51	3:00	Eccentric	5.17	Mixed	0.19
3	Pavun matha	24	F	11554	C L T	F	2.1 KG	C	Circular	14.60	2.296	375	14	54	3:08	Central	5.60	Disperse	0.18
4	Jothi lakshmi	24	F	11463	C L T	F	2.25KG	UC	Oval	17.40	1.617	405	16	62	3:08	Eccentric	5.50	Disperse	0.18
5	Pandeshwari	19	F	11572	C L T	F	2.65KG	UC	Oval	15.80	1.877	435	15	48	3:02	Eccentric	6.00	magistral	0.16
6	Mookammal	24	F	11257	C L T	M	2.4KG	UC	Oval	17.00	2.210	510	12	36	3:00	Eccentric	4.70	Disperse	0.21
7	Eswari	18	F	11529	C L T	F	2.10KG	C	Oval	17.20	2.296	450	15	62	4:01	Marginal	4.40	Disperse	0.22
8	Sathia kala	19	F	11570	C L T	F	2.75KG	UC	Oval	16.40	1.960	490	18	52	2:09	Eccentric	5.60	magistral	0.18
9	Puliammal	20	F	11564	C L T	M	2.7KG	UC	Oval	18.50	1.766	505	15	42	2:08	Eccentric	5.30	Disperse	0.19
10	Majula	28	F	11579	C L T	M	3.2KG	C	Circular	18.50	2.070	540	20	60	3:00	Eccentric	5.90	Mixed	0.17
11	Vasantha	27	F	11677	C L T	F	2.2KG	C	Oval	19.40	1.612	450	17	68	4:00	Eccentric	4.80	Disperse	0.20
12	Vimaladevi	23	F	11548	C L T	F	3.1KG	UC	Circular	17.10	1.877	470	18	82	4:05	Central	6.50	Disperse	0.14

13	Sangaveswari	28	F	11544	C L T	M	2.9KG	UC	Circular	16.70	2.210	500	14	48	3:04	Eccentric	5.80	magistral	0.17
14	Chitradevi	20	F	11559	C L T	M	2.9KG	UC	Circular	18.70	1.667	480	18	68	3:07	Eccentric	6.00	Disperse	0.16
15	Pandiselvi	18	F	11804	C L T	F	2.6KG	UC	Oval	19.70	2.111	435	20	64	3:02	Eccentric	5.90	Mixed	0.17
16	Rubina	24	F	11589	C L T	M	3.2KG	UC	Circular	16.90	2.111	525	18	84	4:06	Eccentric	6.00	Disperse	0.16
17	Amutha	25	F	11822	C L T	M	2.4KG	UC	Oval	19.40	2.070	475	18	62	3:04	Marginal	5.10	Disperse	0.20
18	Bhuvaneswari	20	F	11816	C L T	F	2.9KG	UC	Circular	18.10	1.925	450	15	42	2:08	Central	6.40	magistral	0.16
19	Chandra	31	F	11789	C L T	M	2.2KG	UC	Circular	16.70	1.925	465	16	54	3:04	Marginal	4.70	Mixed	0.21
20	Gokila	23	F	17780	C L T	F	3.1KG	UC	Oval	19.50	1.812	450	18	68	3:07	Eccentric	6.80	Mixed	0.15
21	Angairkanni	25	F	11212	C L T	M	2.5KG	UC	Circular	17.80	2.070	450	18	54	3:00	Eccentric	5.50	Disperse	0.18
22	Sivagami	25	F	11584	C L T	F	2.8KG	UC	Circular	15.90	2.111	425	17	51	3:00	Central	6.50	Disperse	0.15
23	Lakshmi	27	F	37815	C L T	M	2.6KG	UC	Circular	17.10	1.812	500	18	66	3:06	Eccentric	5.20	Mixed	0.19
24	Irulayee	25	F	11576	C L T	M	2.7KG	UC	Circular	18.40	2.516	490	18	78	4:03	Central	5.50	Disperse	0.18
25	Lakshmi	24	F	11125	C L T	M	2.7KG	UC	Oval	17.80	1.960	425	17	54	3:01	marginal	6.30	Disperse	0.16
26	Sornam	21	F	11819	C L T	F	2.7KG	UC	Circular	17.80	2.111	450	15	68	4:05	Eccentric	6.00	magistral	0.17
27	Sangeetha	20	F	11579	C L T	M	2.8KG	UC	Circular	17.30	1.766	500	18	82	4:05	Central	5.60	magistral	0.18
28	Muthumariyammal	20	F	11574	C L T	M	3.0KG	UC	Circular	16.80	2.210	495	16	64	4:00	Eccentric	6.00	Disperse	0.17
29	Sudha	23	F	10891	O T	F	3.5KG	UC	Circular	16.70	2.111	460	17	62	3:05	Marginal	7.60	Disperse	0.13
30	Vijaya lakshmi	22	F	11838	C L T	F	2.3KG	C	Oval	20.90	1.717	420	18	64	3:05	Eccentric	5.40	Disperse	0.18
31	Kartheeswari	27	F	11430	O T	F	3.0KG	UC	Circular	17.70	1.960	450	15	40	2:06	Eccentric	6.60	Mixed	0.

																			15
32	Panbu Jothi	25	F	11337	O T	M	3.25KG	UC	Circular	16.80	2.111	525	20	62	3:01	Central	6.10	Disperse	0.16
33	Selvi	25	F	11450	C L T	M	2.6KG	UC	Circular	17.30	2.210	480	18	58	3:02	Central	5.40	Disperse	0.18
34	Maimoon	20	F	11807	C L T	F	2.3KG	UC	Oval	19.70	1.925	450	17	62	3:05	marginal	5.10	Disperse	0.20
35	Yogamalar	25	F	11634	O T	M	3.3KG	UC	Oval	18.60	1.766	475	20	56	3:04	Eccentric	6.90	Mixed	0.14
36	Bala Sararwathy	34	F	11820	C L T	F	2.8KG	UC	Circular	16.90	2.197	460	15	40	2:06	Eccentric	6.00	Mixed	0.16
37	Aruna Devi	21	F	11784	C L T	M	2.7KG	UC	Oval	19.70	1.925	460	14	52	3:07	Eccentric	5.80	Disperse	0.17
38	Mahalakshmi	25	F	11320	C L T	F	2.1KG	C	Circular	16.60	2.210	465	16	54	3:04	velamentous	4.50	Disperse	0.22
39	Sundari	20	F	11586	C L T	F	3.25KG	UC	Circular	17.40	2.197	450	20	71	3:05	Central	7.20	Disperse	0.14
40	Muthu Priya	20	F	11682	C L T	M	2.9KG	UC	Circular	19.30	1.717	540	14	38	2:07	Eccentric	5.30	magistral	0.19
41	Kaleeshwari	19	F	11689	C L T	F	2.8KG	UC	Oval	16.67	2.210	500	16	69	4:03	Central	5.60	Disperse	0.18
42	Rajeswari	30	F	11678	C L T	M	2.0KG	UC	Circular	17.60	1.925	460	18	56	3:01	Marginal	4.30	Mixed	0.23
43	Amutha	26	F	11409	C L T	M	3.0KG	UC	Circular	18.00	2.197	450	16	70	4:03	Eccentric	6.60	Disperse	0.15
44	Viji	22	F	11728	C L T	M	3.5KG	UC	Oval	17.50	2.070	505	19	45	4:02	Marginal	6.90	magistral	0.14
45	Kannaki	28	F	11781	C L T	F	3.0KG	UC	Circular	19.50	1.717	490	15	52	3:04	Eccentric	6.10	Disperse	0.16
46	Jamuna Rani	23	F	10943	C L T	M	2.5KG	UC	Oval	18.90	2.070	470	16	68	4:02	Central	5.30	Disperse	0.19
47	Chitra	22	F	11569	C L T	M	2.75KG	UC	Circular	17.30	2.111	490	17	54	3:01	Marginal	5.60	Disperse	0.18
48	Karthiga	19	F	11698	C L T	M	3.3KG	UC	Triangular	17.60	1.925	495	16	68	4:02	Eccentric	6.60	Disperse	0.15
49	Sajitha Banu	27	F	11473	C L T	F	2.4KG	UC	Oval	19.20	1.717	470	16	52	3:02	Eccentric	5.10	Mixed	0.20

50	Aachi	25	F	11677	C L T	M	3.0KG	UC	Circular	17.20	2.210	505	18	56	3:01	Eccentric	5.90	Disperse	0.21